COVER PHOTO: Marketing of medicinal plants in the Sudan (C. Palmberg, FAO)

Some medicinal forest plants of Africa and Latin America

Forest Resources Development Branch
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FAO Forestry Department

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ABSTRACT

The 40 monographs on medicinal trees and shrubs presented in this book were prepared in collaboration with 9 institutes in Africa and Latin America. They include information on the botany and silvics as well as the chemical properties and pharmaceutical and traditional uses of each species. The book is a companion volume to earlier FAO publications on Food and Fruit-bearing Forest Trees, published for three regions.

FOREWORD

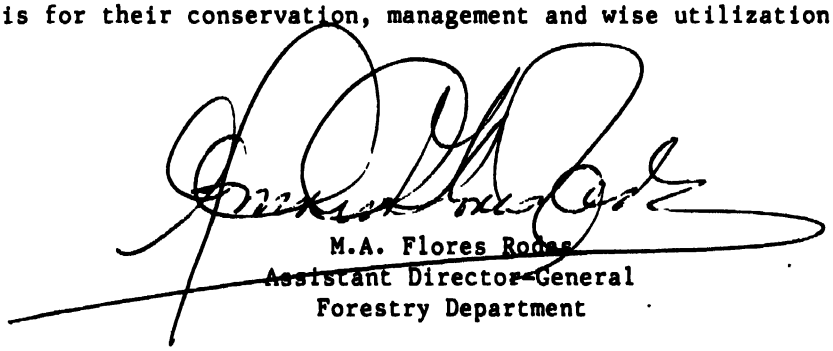
Trees and shrubs are the source of many products besides timber. These products make an important contribution to the welfare and quality of life of urban as well as rural communities expecially in the tropics and sub-tropics. Much of the knowledge and the technology of processing of such products is only available in rural communities and only perpetuated by word of mouth and within families and small communities. These are fragile traditional skills and are likely to be lost when communities emigrate to towns or to regions with a different flora, or if the local ecology is drastically altered.

Pressure is increasingly being exerted on natural forests - by agriculture, by demand for browse and grazing, by demands for fuelwood and to make way for industrial plantations. Indeed the awareness of the therapeutic value of some forest species has in itself endangered them as a result of indiscriminate exploitation. Our knowledge of the chemical properties, ecological requirements and silvics of most of the species is so limited that plantations and *ex situ* conservation is seldom a feasible option. *In situ* conservation, on the other hand, is only possible when decision-makers are fully aware of the potential value of these forest species; and when their biological and management requirements are known.

The present publication has been produced in response to recommendations by FAO governing and statutory bodies, as well as to recommendations of the World Forestry Congresses in Jakarta and Mexico, urging international organizations to work for the conservation, promotion and rational utilization of forest products other than timber. As such it complements FAO Forestry Paper No. 44 - Food and Fruit-bearing Forest Species, which draws attention to the value of forests as a direct source of food and fodder for local communities.

Compilation of information was done in collaboration with nine institutions in Africa and Latin America; each institute was requested to propose a list of some 20 priority species, for which monographs could be prepared, using primarily information available in the country. From these lists 40 species of trees and shrubs representing 27 families were selected for publication, both for the variety of their traditional and pharmaceutical uses, and also so as to include a wide range of different types of woody plants.

In addition to drawing attention to the multiple uses of the forests this publication aims at collating and publishing data on the botany, ecology and silvics as well as the chemical properties and pharmaceutical and traditional uses of each species; and at revealing gaps in our knowledge of these species. It is hoped that this book will not only promote further publications on this subject from other sources, but will also encourage research into the ecology and therapeutic properties of trees and shrubs, thus providing a solid basis for their conservation, management and wise utilization.



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LIST OF PLATES AND DISTRIBUTION MAPS

GLOSSARY

Abortifacient	:	inducing abortion
Anthelmintic	:	expelling or destroying parasitic worms, especially of the intestines.
Antisporic	:	relieving itches
Aperient	:	gently moving the bowels; a laxative
Astringent	:	drawing together soft organic tissues; a styptic.
Atherogenic	:	causing "hardening" or atheromata of the arteries
Bechic	:	tending to cure or relieve a cough; an expectorant
Bilharziasis	:	Schistomasis
Cardiotonic	:	tending to increase the strength of the heartbeart
Chemovar	:	a variety or form of a species distinguished from other members of its species at least in its chemical composition.
Chemurgic	:	of use to the chemical industry
Diaphoretic	:	increasing perspiration
Dysenteric	:	dispelling dysentery or severe diarrhoea
Emetic	:	inducing vomiting
Emmenagogic	:	inducing menstruation
Endothelium	:	the layer of the cells that lines the cavities of the heart, of the blood and lymph vessels and the serous cavities of the body.
Expectorant	:	promoting discharge of mucus from the respiratory tract
Febrifuge	:	mitigating or removing fever
Frugivorous	:	containing large quantities of fruit in the diet
Guinea-worm	:	a thread-like nematode, Drancunculus medinensis; a rather common parasite of humans, at least in Africa.
Haemostatic	:	stopping bleeding
Hypoglycemic	:	tending to lower blood sugar, especially glucose
Hypotensive	:	causing low blood pressure or a lowering of blood pressure
Purgative	:	purging or tending to purge; cathartic
Rubefacient	:	inducing redness of the skin by external application
Vicariadism	:	the state of showing similarities, usually in distinct geographic areas, of morphology and for utilization e.g. vicarious usage of Artemisia spp. by the Amerindians, Bedouins and Chinese.

INTRODUCTION

The present book emphasises the value of medicinal resources both to the local and to the world economy and welfare; it is a value that is too often unappreciated. Nevertheless for about 80% of the world's rural population the herbalist is the only person who handles local medical problems (Ayensu, 1983). The study of folklore medicine can also indicate potential sources for modern, industrial drugs. "Aspirin, probably the world's most widely used drug, could not have been developed without the chemical blueprint supplied by willow bark" (Wachtel, 1983).

Although some natural drugs have been synthesized, the process is usually very expensive in energy. Only about 3% are amenable to commercial synthesis (Farnesworth, 1977). As the cost of energy increases, it must be anticipated that reliance will be increasingly placed on natural, rather than synthetic sources for drugs. There are thousands of complex organic chemicals, sometimes known as secondary plant metabolites, some of which are medicinal. Only about 10 000 have been defined chemically, of which some 4 500 are alkaloids, 1 200 are flavanoids and 1 100 are terpenes.

Although chemical screening has been done on less than 1% of the tropical species, already some 260 South American plants have been identified, e.g. as having potential for birth control. Some 1 400 tropical forest species are believed to have anticancer properties. Rotenoids from the roots of tropical trees, for example, are being tested clinically as antitumor drugs: Tabebuia serratifolia, Jacaranda caucana and Croton tiglium are tropical trees, and each produces a unique anticancer compound whose effectiveness has been proven in the laboratory. Tropical forest plants are significant in treating other medical problems, notably hypertension. (OTA, 1984).

Some 350 million people are affected by malaria; in many areas pathogen resistance has developed against the earlier widely used drug, chloroquine. It is possible that traditional plant febrifuges used by herbalists for treating malaria, e.g. Artemisia annua in China, may contain the basis of a new anti-malarial drug. Schistosomiasis (bilharziasis), which affects 300 million people, is carried by a snail. Synthetically derived molluscicides cost about $18 000 per metric tonne, a high price (Farnesworth, 1984). A phytomolluscicide, endod, exists: if it can be developed for effective and safe use for humans, it might be possible to control another serious tropical disease.

In this book 40 tropical forest species having medicinal potential are described. The range of uses is very large. Calotropis procera, a small milkweed tree, has an array of uses, many of which are medical. The latex, which contains digitalic compounds, has also been suggested as a source of energy hydrocarbons; kapok-like fibres are derived from the hairs at the ends of the seeds, which themselves contain 35% oil and more than 25% protein. This tree grows in dry climates and could be a source not only of medicines, but also floss, fibre, rubber, energy, proteolytic enzymes, charcoal and, after detoxification, leaf-protein. It appears to have as much energy potential in the arid tropics as the milkweed, Asclepias syriacea L., has in the temperate zone (Duke, 1984b).

Entada abyssinica has not been as intensively studied as some other multipurpose trees. The saponins reported to be present in this small tree may explain some of its medicinal properties. Any species from which can be derived a product that will selectively kill snails without damaging the environment may help solve the huge schistosomiasis problem. Other species of Entada are said to provide the fish poison rotenone, gum arabic and gum tragacanth (Allen and Allen, 1981). Both saponins and rotenones are biologically active and have shown some experimental antitumour activity.

Khaya senegalensis (Desr.) A. Juss. has a well deserved febrifugal reputation. This tree, one of the African mahoganies, provides, besides a valuable timber, medicine, fish poison, polysacchrides, charcoal, tannins and a seed oil. Two antitumour sterols, perhaps ubiquitous, beta-sitosterol and its glucoside are among many biologically active components listed for this tree. The African mahogany shares with neem (Azadirachta indica, another member of the Meliaceae) antimalarial and insect repellent properties.

The physic nut, Jatropha curcas L. originates from tropical America and owes its pantropical occurrence as a cultivated tree more to its medicinal attributes than to its other properties. The information on the traditional medicinal uses for this tree is voluminous, but the nut is in fact rarely eaten after processing, though its unprocessed seeds are cathartic, sometimes drastically so. The oil constituting about 40% of the seeds has, like its relative the castor oil tree, been suggested as an energy source. Four anti-tumour compounds are reported from other species of Jatropha. As a potential source of energy, insect repellent, illumination, lubricating oil, medicine and tannins, the physic nut could well make a useful contribution to many agroforestry schemes.

Maytenus buchanahii (Loes.) Wilezek is widely distributed in tropical Africa and was, at one time, thought to have great potential as the producer of the anticancer compound maytansine. However, in clinical trials it was shown to have serious side effects, and the Japanese have now shown that maytansinoids can be produced using micro-biological techniques. Nevertheless considerable interest in M. buchananii is still being shown in some parts of the world.

Ipecac consists of the dried rhizone of Psychotria ipecacuanha (Brot.) Stokes which grows in South America. The cortex contains most of the active ingredients (the alkaloids emetine, cephaline and psychotrine). Ipecac is used medicinally as an emetic, expectorant, astringent and diaphoretic. It is a specific for amoebic dysentry; in India it has been used to treat bilharziasis, guinea worms and oriental sores (Duke, 1984b). Emetine hydrochloride has been shown to be active against several tumour systems (Perdue and Hartwell, 1976). The popularity of ipecac in traditional medicine as a cancer cure may be well founded. Even the crude extract finds its way into more than 7 million prescriptions every year in the U.S. In India the species has been cultivated successfully (Atal and Kapur, 1982).

Rauvolfia vomitoria Afzel also appears to be easy to cultivate since it is reported to be used as live fencing, as shade for cocoa and supports for vanilla. However, there are no references to it being cultivated as a commercial crop; despite this 700 tonnes of roots were exported from the Congo in 1954. As a source of reserpine for the European and American market, R. vomitoria has now replaced the Indian Rauvolfia which has been exploited to the point of extinction. Reserpine is an important hypotensive sedative; in addition more than 70 alkaloids have been isolated from this tree (Iwu and Court, 1982).

The tonadora, Tecoma stans (L.) occurs throughout the tropics as a popular garden ornamental shrub. It originates from Mexico where it is widely used in two potent medicines for treating diabetes (Glucolisina and Diabetoline), though these are not yet recognised by the medical profession. T. stans contains lapachol, sitosterol and ursolic acid, so-called antitumour compounds. Tacomine and tecomaline, the hypoglucemic agents, have an LD50 of 330 mg/Kg in mice suggesting that these compounds are less toxic than caffeine.

The past two decades have witnessed the synthesis of many hundreds of chemical variants of known classes of cancer chemotherapeutic agents. Synthesis of modifications of presently known drugs does and should continue. However, some pessimism is evident among workers in the field because of the relatively small improvements over the prototype drugs that have resulted from the extensive synthetic efforts to date. There exists a need for new prototypes, or templates, for the synthetic organic chemist to use in the design of potential chemotherapeutic agents. Recent studies in the isolation and structural elucidation of tumor inibitors of plant origin are yielding a fascinating array of novel types of growth-inhibitory compounds. There appears to be a reason for confidence that this approach may point the way to useful templates for new synthetic approaches to cancer chemotherapy (Kupchan, 1972). Many of these useful templates come from forest species, some of which are discussed in this book.

Once biological activity has been discovered, then the pharmaceutical firms often analyse the compound responsible for the activity and, using it as a template, move on to bigger and better modifications of the template.

A number of researchers feel that the major purpose for finding in plants new structures having biological activity is to provide templates for the synthesis of analogues and/or derivatives which will have equivalent or better activity than the parent molecule. History shows that it is exceptionally rare that a naturally occurring chemical compound which has found utility as a drug in man will yield a derivative on structure modification that exceeds the value of the parent compound in drug efficacy.

This does not discount the value of such model compounds as cocaine yielding information that led chemists to produce related local anaesthetics such as procaine and its congeners, nor the value of the large number of synthetic anticholinergic drugs that were designed from the tropane nucleus and which have their own specific advantages.

Finally the value of plant derived chemical compounds as building blocks for semi-synthetic derivatives cannot be underestimated. The classical example is the use of diosgenin as the primary starting material for the synthesis of the majority of steroidal hormones currently used in medicine (Farnsworth, 1977).

Physiological research

Holmstedt (1972) shows that medicinal plants have yet a third value to man, over and above the medicine and template. "Many drugs have played a role not only in the cure and alleviation of disease but also as tools in elucidating physiological and pharmacological mechanisms. Among the latter may be mentioned atropine, curare, muscarine, nicotine, and not least, physostigmine. Physostigmine, also called eserine, is an alkaloid contained in the Calabar bean, Physostigma venenosum Balf. It is an open question which of the above mentioned alkaloids has contributed most to pharmacology. One thing is sure - we could not have advanced in our understanding of basic mechanisms without any one of them. The story of the Calabar bean and physostigmine and its role in medicine is perhaps less well known than curare".

Conservation

On Barro Colorado Island there is a small tropical moist forest reserve that has been intensively studied by Croat (1978). An analysis of the flora of this small reserve (less than 200 ha) revealed that 55% of the 1369 species were woody (including epiphytes and climbers). Some 395 (29%) of the listed species have been recorded as being used in traditional medicines; of these medicinal plants 123 were trees and 70 were lianes. Few tropical moist forests have been analysed in detail in this way, but it is likely that throughout the tropics the proportion of woody plants recognized as traditional medicines and with some potential as sources of modern drugs will be of the same order as in Barro Colorado Island. Yet tropical forests are being lost at the alarming rate of more than 11 million hectares annually (Lanly 1982). Every year species are estimated to become extinct; our knowledge of their chemical constitution and potential is minimal at best and mostly non-existent. Ironically the fact that many have medicinal potential has resulted in some species becoming endangered, for instance Rauvolfia serpentina. A logical response to this situation is the cultivation of the tree as a crop. This, however, is only a partial solution to the problem. For some species we know that they require conditions of shade, as found in the tropical moist forest, in order to grow. For many species, silvicultural requirements need to be studied to enable us to bring useful germplasm into cultivation while, at the same time, the full intraspecific variation of the species is conserved to meet changing needs in environmental conditions and end use requirements.

Our ignorance of intraspecific variation of medicinal species is the cause of the criticism that - due to environmental and genetic variation - dosages of active ingredients in herbal medicines are difficult or impossible to accurately determine. For example, Rauvolfia vomitoria Afzel, grown in the Congo, contains 10 times more reserpine than that grown in neighbouring Uganda. Sarmentogenin, a steroidal sapogenin found in Strophanthus sarmentosus DC., has been viewed as a possible precursor in the synthesis of cortisone. In search of better materials, twenty species of Strophanthus and 23 samples of Strophanthus sarmentosus, were gathered in a 16 000 mile trek through 12 Central African countries. Not one contained the sarmentogenin. Examination of 50 different African samples of the species showed 4 chemically distinct varieties, only one of which produced sarmentogenin in reasonably detectable amounts.

Conservation methods must thus be based on, and supported by, genecological exploration and evaluation of existing germplasm, as a means towards sound utilization of the valuable resource that medicinal plants constitute both for local well-being and for industrial use.

REFERENCES (INTRODUCTION)

Allen, O.N. and Allen, E.K. (1981) The Leguminosae. A Source Book of Characteristics, Uses, and Nodulation. U. Wisc. Press, Madison, 812 pp.

Atal, C.K. and Kapur, B.M. Eds. (1982) Cultivation and Utilization of Medicinal Plants. RRL, CSIR, Jammu-Tawi, India, 877 pp.

Ayensu, E.S. (1983) Endangered plants used in traditional medicine. pp. 175 - 183 in Bannerman, Burton and Chieh, eds. Traditional Medicine and Health Care Coverage, WHO, Geneva, 342 pp.

Brown, L.R. (1984) State of the World - 1984. Lecture presented at Beltsville, MD, March 14, 1984.

Bruhn, J.G. and Holmstedt, B. (1981) Ethnopharmacology: Objectives, Principles and Perspectives, pp. 405-430 in Beal, J.L. and Reinhard E., Eds. Natural Products as Medicinal Agents. Hippokrates Verlag. Stuttgart, 526 pp.

CU (Consumers Union) (1976) The Medicine Show. Consumer Reports. Mount Vernon, New York, 384 pp.

Croat, T.B. (1978) Flora of Barro Colorado Island, Stanford U. Press, Stanford, Ca., 943 pp.

Duke, J.A. (1972) Isthmian Ethnobotanical Dictionary. Published by the Author, Fulton, MD, 96 pp. Being reissued with illustrations by Scientific Publisher, Jodpur, India.

Duke, J.A. (1981) Magic Mountain, 2000 AD. Paper No. 2, pp. 151-156, in 87th Congress, 1st Session. Background Papers for Innovative Biological Technologies for Lesser Developed Countries, An Office of Technology Assessment (OTA) Workshop, Washington, DC.

Duke, J.A. (1982) Contributions of Neotropical Forests to Cancer Research. Trop. Silviculture (Newsletter) Sept. 1982, pp. 2-5.

Duke, J.A. (1983a) The USDA Economic Botany Laboratory's Data Bank on Minor Economic Plant Species, pp. 196-214, in Plants: The Potential for Extracting Protein, Medicines, and other Useful Chemicals - Workshop Proceedings, Washington, D.C., US Congress OTA Publ. OTA-BP-F-23.

Duke, J.A. (1983b) Medicinal Plants of the Bible, Trado-Medic Books, Buffalo N.Y., 233 pp.

Duke, J.A. (1984a) Folk Cancer Plants Containing Antitumor Compounds in Etkin, N.L. ed.

Duke, J.A. (1984b) Handbook of Medicinal Herbs, in ed. CRC Press, Boca Raton, Fla.

Duke, J.A. and Wain, K.K. (1981) Medicinal Plants of the World. Computer Index with ca 90,000 entries, 3 vols., 1654 pp.

FAO (1983) Food and Fruit Bearing Forest Species 1: Examples from Eastern Africa. FAO Forestry Paper 44|1. FAO, Rome.

FAO (1984) Food and Fruit Bearing Forest Species 2: Examples from Southeastern Asia. FAO Forestry Paper 44/2. FAO, Rome.

FAO (1985) Food and Fruit Bearing Forest Species 3: Examples from Latin America. FAO Forestry Paper 44/3. FAO, Rome.

Farnsworth, N.R. (1980) Rational Approaches Applicable to the Search for and Discovery of New Drugs from Plants. Typescript. Presented at the First Latin American and Caribbean Symposium on Naturally Occurring Pharmacological Agents, Havana, Cuba, June 23-28, 1980.

Farnsworth, N.R. (1984) How Can the Well be Dry When it is Filled With Water? Econ. Bot. 38(1): 4-13.

Farnsworth, N.R. and Loub, W.D. (1983) Information Gathering and Data Bases that are Pertinent to the Development of Plant-Derived Drugs, pp. 178-195, in Plants: The Potentials for Extracting Protein, Medicines, and other Useful Chemicals - Workshop Proceedings (Washington, D.C. US Congress, Office of Technology Assessment, OTA-BP-F-23, Sept. 1983.

Gillis, W.T. (1971) Systematics and Ecology of Poison-ivy and the Poison-oaks. Rhodora 73: 72-159; 161-237; 370-443; 465-540.

Holdridge, L.R. (1947) Determination of World Plant Formation from Simple Climatic Data. Science 105: 367-8.

Holmstedt, B. (1972) The Ordeal Bean of Old Calabar: The Pageant of Physostigma venenosum in Medicine, pp. 303-360, in: Swain, T., ed. Plants in the Development of Modern Medicine. Harvard Univ. Press, Cambridge, Mass. 367 pp.

Iwu, M.M. and Court, W.E. (1982) Stem Bark Alkaloids of Rauwolfia vomitoria. Planta Medica 45: 105-111.

Kupchan, S.M. (1972) Recent Advances in the Chemistry of Tumor Inhibitors of Plant Origin. pp. 261-278 in Swain, T. 1972. Plants in the Development of Modern Medicine. Harvard Univ. Press, Cambridge, Mass. 367 pp.

Lanly, J.P. (1982) Tropical Forest Resources, FAO Forestry Paper 30. FAO, Rome.

Levingston, R. and Zamora, R. Medicine Trees of the Tropics. Unasylva 35(140): 7-10. (1983)

Lewis, W.H. and Elvin-Lewis, M.P.F. Medical Botany. Wiley-Interscience, John Wiley (1977) and Sons, New York, 515 pp.

Masquelier, J. (1981) Pycnogenols: Recent Advances In the Therapeutical Activity of Procyanadins, pp. 243-256 in Beal, J.L. and Reinhard, E., eds. Natural Products as Medicinal Agents. Hippokrates Verlag, Stuttgart, 526 pp.

Morton, J. (1977) Major Medicinal Species. Chas. C. Thomas, Springfield, 111. 431 pp.

O.T.A. (1984) Technologies to Sustain Tropical Forest Resources (Washington, D.C. US Congress, Office of Technology Assessment, OTA-F-214, Mar. 1984) 344 pp.

Perdue, R.E., Jr. (1981) Maytenus buchananii, Source of Maytansine. Am. Soc. Pharmacognosy (Newsletter) 18(1): 8-10.

Perdue, R.E., Jr. and Hartwell, J.L. eds. Proceedings of the 16th Annual Meeting of (1976) the Society for Economic Botany: Plants and Cancer. Cancer Treatment Reports 60(8): 973-1215.

Schauf, V. (1984) East-West Efforts Key into Leprosy Research. JAMA 251 (1): 15-18.

Sherman, C. (1982) The Medical Harvest from Foxglove to Ginseng. SciQuest (Apr. 82): 5-9.

Sittig, M. (1983) Manufacturing Processes for New Pharmaceuticals. Noyes Publications, Park Ridge, N.J.

Swain, T. (1972) Plants in the Development of Modern Medicine. Harvard Univ. Press, Cambridge, Mass. 367 pp.

Tudge, C. (1984) Drugs and Dyes from Plant Cell Cultures. New Scientist (Jan. 12): 25.

Wachtel, P. (1983) Saving the Plants that Save Our World. Wildlife Foundation. Gland, Switzerland, 16 pp.

Willis, J. (1983) Back Pain: Ubiquitous, Controversial, FDA Consumer 17(9): 4-7.

1. BOTANICAL NAME: Achyranthes aspera L.

SYNONYMS: Achyranthes canescens R.Br.
Achyranthes argentea Decne.
Achyranthes grandifolia Moq.
Achyranthes obovata Peter

FAMILY: Amaranthaceae

COMMON NAMES: Buhulula (Kibende, Kibondei); Ngoto (Kisamba), Nara (Kiluguru); Ndadaulo (Kisafwa); Pururа, Purule (Kiswahili); Nugulukauna (Kihehe); Iremenzano (Kipare); Mpululu, Mnamato, Mbakwe (Kigogo). Ikulula, Kyululankanga (Kirangi); Munyori, Mnyoli (Kinyaturu); Lukululankanga (Kinyamwezi).

2. ECOLOGY AND DISTRIBUTION

Achyranthes aspera is a widespread weed occurring on a variety of soils from sea level to 2600m or more in semi-arid areas receiving c.250mm rainfall to high rainfall savannas with over 2000mm annual rainfall. The species is one of the first invaders after cultivation, also found by road-sides, waste places, etc.

The species is widespread in tropical Africa (see distribution map), being found in the Cape Verde Islands, Senegal, Gambia, Mali, Guinea, Sierra Leone, Liberia, Ghana, Niger, Nigeria, Cameroon, Chad, Cabinda, Zaire, Rwanda, Burundi, Sudan, Ethiopia, Somalia, Uganda, Kenya, Tanzania, Mozambique, Malawi, Zambia, Zimbabwe, Botswana, Angola, Namibia and South Africa, also in Asia, Australia, West Indies, Central and South America.

3. DESCRIPTION

An erect or suberect, annual or perennial herb 0.5-1.5m high, root stock woody, branches ascending, pubescent. Leaves opposite, simple, stipules absent, blade ovate to ovate-lanceolate or ovate-oblong, 1.5-16cm long, 0.7-7cm wide, apex rounded, acute or shortly acuminate, base cuneate to rounded margins entire, pubescent above and below; petiole 0.5-3cm long. Inflorescence a terminal and an axillary, many-flowered spikes up to 75cm long; rachis robust, pubescent; bracts persistent, long-acuminate, 2-3.5mm long, before anthesis erect, later spreading, silvery pubescent; bracteoles 2, spinescent, c3-4.5mm long; flowers solitary in the axil of the bract, hermaphrodite, 5-merous. sepals pinkish or greenish, ovate-lanceolate, 3.5-5.5mm long, later enlarging to 4.5-6.5mm, hardening and becoming pungent; stamens 5, ovary turbinate, ovule 1, style 1-2mm long. Fruit an utricle 2.5-3mm long, falling with the perianth and bracteoles.

The species flowers and fruits throughout the year. It appears that flowering and fruit maturing occur concurrently. It is also interesting to note that the plant is in leaf throughout the year, even in semi-arid areas.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Chhabra (Pers. Comm.) reports that A. aspera contains saponin which is a cardiac stimulant. The Benzene extract is arbortificient and a preparation of this plant with zinc metal is fungicidal. Two compounds Bentaine and Ecdystrone have been reported to be isolated from this plant.

5. FOLK MEDICINAL USES

A. aspera leaves are taken and fire cured, then ground. The powder is then applied on cuts made with a razor blade in cases of ankle sprains. It is used together with commercial salt. It is also a medicine for headache.

Roots chewed and applied on cuts will stop bleeding. A decoction made from the roots is used as medicine for constipation in children and to cure stitch. The pounded root is steeped in hot water, and the extract drunk cold as a cure for venereal diseases.

The ash of the burned leaves is applied on boils. The plant is also used as a charm against evil spirits (Kokwaro, 1976). An infusion of the root of A. aspera is an ametic, for pains in the chest not due to coughing. The steam from boiling the plant is inhaled and used as a hot bath for acute chills. The juice of the plant is reported to dissipate opacity of the cornea and to relieve toothache, dysentery and other bowel complaints.

The ash of the plant, from which a salt is prepared is used in the treatment of scabies, when mixed with honey the ash is used as a cough remedy (Watt and Breyer - Brandwijk, 1962). Chhabra (Pers. Comm.) reports that A. aspera is used for treating leprosy and kidney troubles.

The decoction of A. aspera root is gargled as a remedy for toothache. The roots are chewed and applied on a recent snake bite. A decoction of the root is drunk as a remedy for malaria, heartburn, generalised pains and to cause vomiting as an antidote for poison. A decoction of root and leaves is drunk as anthelmintic. It is also used for preventing miscarriage in pregnant women.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Chhabra (Per. Comm.) reports that A. aspera contains saponin, benzene, bentaine and ecdystrone. Watt and Breyer - Brandwijk (1962) observed that the fruit contains a large percentage of alkaline potash ash. It has also been observed that in India the seed yields 2 per cent of saponin, the sapogunin of which $C_{29}H_{46}O$ mp 305 - 6° may be a steroid. A hydrocarbon was isolated from the fatty fraction.

7. HARVESTING, CONSERVING AND PREPARATION

A. aspera plant is uprooted, the root washed, cut into small pieces and either boiled in preparation of a decoction or dried and then boiled to form a decoction or pounded into powder and then put in water to form an infusion.

The leaves are pounded and then put into water to form an infusion or boiled to form a decoction.

The roots are cut into small pieces, dried and tied into small bundles and stored in a dry place. The leaves are not stored. This is because as they are dry they lose their effectiveness.

An infusion, a decoction or poultice are the forms in which A. aspera is used.

8. ECONOMICS AND MARKETING

There has been no investigation into the economics of the medicinal values of A. aspera. However, local herbalists collect the roots and leaves which they process to form infusions, decoction or poultices which they sell for various remedies. It is anticipated that the isolation of the effective ingredients by the Traditional Medicine Research Unit (Muhimbili) and when ways of preserving these ingredients are found, it will be possible to establish it in plantations and collect the raw material in large quantities on a commercial scale.

9. SILVICS

The species regenerates naturally from coppice and seed. Germination of seed takes place at the onset of the rainy season on recently cultivated areas or cleared forests.

The species grows in open areas, it does not tolerate shade.

There have been no efforts to regenerate the species artificially. However, since the seed germinates well, there is a possibility of raising it and establishing seedlings in well-maintained plantations.

10. MAJOR DISEASES.

None specified or known.

11. OTHER USES

It is used as a charm against evil spirits and to ward off misfortune.

It provides livestock forage especially during the dry season when grass is dry.

It is a notorious weed in fields - a disadvantage to farmers, a feature that promises a ready aptitude for artificial establishment.

12. BIBLIOGRAPHY

Anon (1976) Atlas of the United Republic of Tanzania. Surveys Division. Min. of Lands. Dar es Salaam.

Kokwaro, J.O. (1976) Medicinal Plants of East Africa. E.A. Literature Bureau. Nairobi.

Morgan, E.T.W. (1972) East Africa: its peoples and resources. Oxford University Press. Nairobi. 312p.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa. E. & S. Livingstone Ltd. London 1455 p.

PLATE I. Achyranthes aspera L.

Plate 1-2 branchlet bearing flowerbuds and flowers

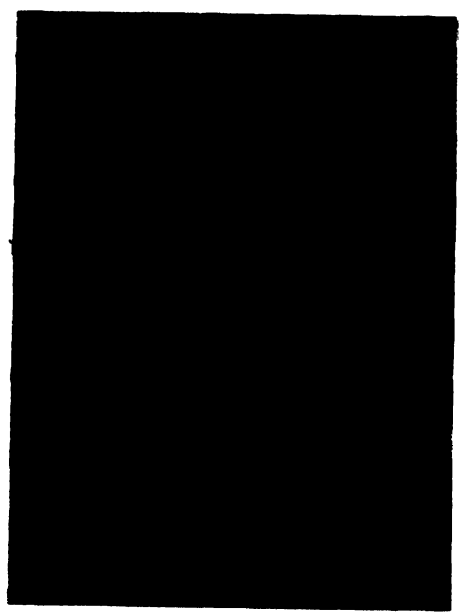
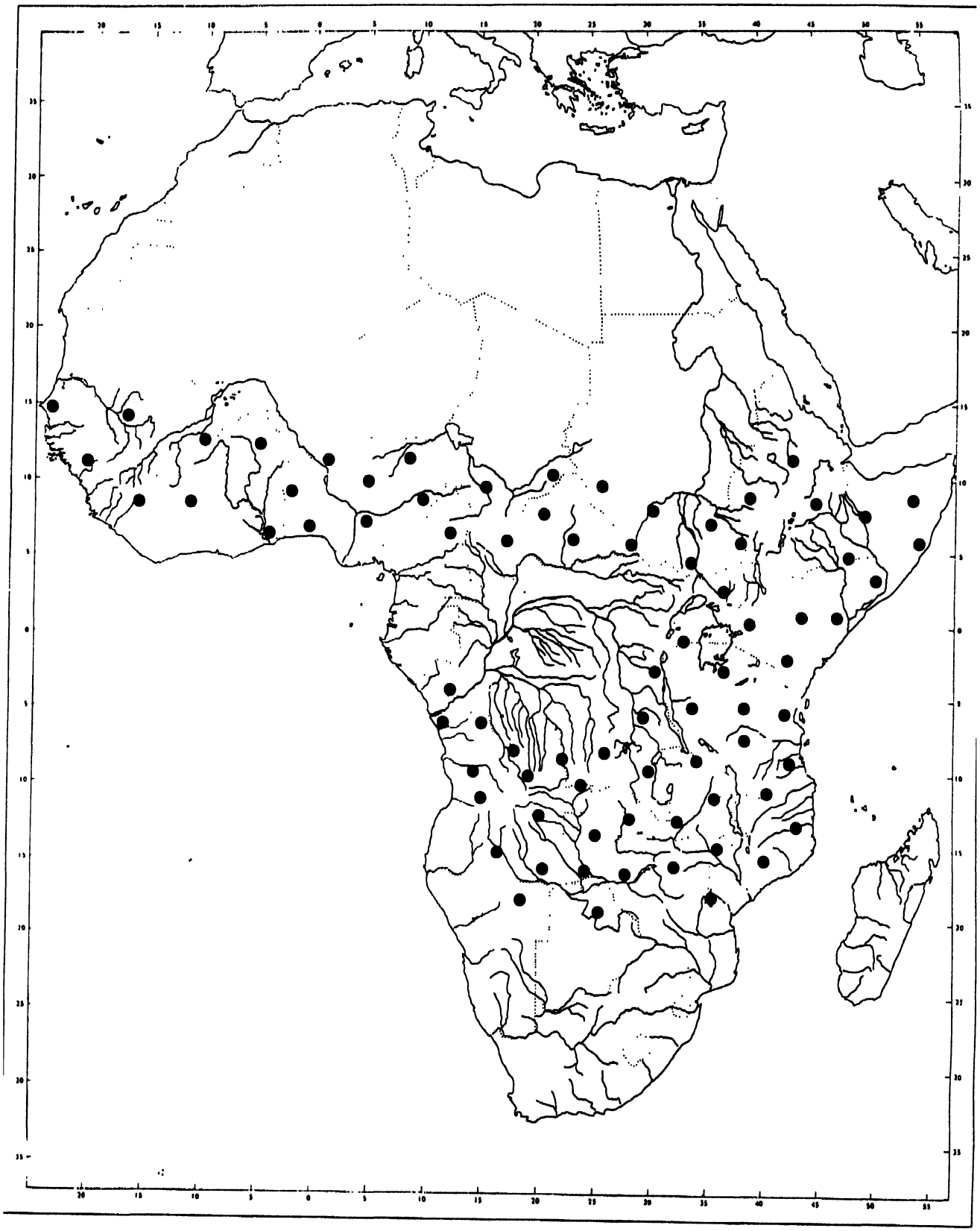


Plate I. Achyranthes aspera L.

branchlet bearing flowerbuds and flowers

Plate I-1 plant at Majengo, Dodoma - May 1983 (Photo Ruffo)

MAP 1 - Geographic distribution of Achyranthes aspera



1. BOTANICAL NAME: Alchornea cordifolia (Schum. & Thonn.) Muell. Arg.

SYNONYMS: Schousboea cordifolia Schum. & Thonn.
Alchornea cordata Benth.

FAMILY: Euphorbiaceae

COMMON NAMES: Christmas bush; Gyamma (Twi, Ashanti, Fante), Gyeka (Nzema), Gyaka (Sefwi, Aowin), Gboo, Gbloo (Adanme), Ahame (Ewe), Ayraba (Peki), Ipa, Ewe ipa (Yoruba), Ubube, Ubebo (Ibo), Bambari (Hausa), Tahi (Gbari), Epai (Ijaw), Mbom (Efik).

2. ECOLOGY AND DISTRIBUTION

In Nigeria Alchornea cordifolia grows in secondary regrowth within moist lowland forest (Map) and around seasonal swamps and brooks in dry forest.

Widely distributed in tropical Africa, occurring in Senegal, Gambia, Mali, Guinea Bisau, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Dahomey, Niger, Nigeria, Cameroun, Fernando Po, Gabon, Cabinda, Zaire, Rwanda, Burundi, Sudan, Uganda, Kenya, Tanzania and Angola (see distribution map).

3. DESCRIPTION

Erect or scrambling, multistemmed shrub, woody climber or small tree up to 10m high, 10cm in diameter; slash produces colourless, watery exudate; branchlets drooping, ferruginous brown, tomentose, lenticellate. Leaves alternate, simple, stipules absent; petiole 5-13cm long; blade broadly ovate, 9-28cm long. 7-16cm wide, apex acute to acuminate, base cordate, with 2 sessile glands, margins subentire, entire or wavy, papyraceous, deep to mid-green and rather glossy above, paler below, midrib and 4-6 pairs of major lateral veins more prominent and rusty-brown tomentose below becoming glabrescent. Male inflorescence axillary panicles 8-36cm long, flowers minute, greenish white, calyx 4-lobed, stamens 6-8; Female inflorescence axillary, lax elongate simple or branched spikes, up to 38cm or more long, ovary 2-celled, styles 2, up to 20mm long, more-or-less persistent. Fruit obovate, 5-8mm long, 8-12mm wide, 2-valved, brown stellate-pubescent; seeds 1-2, subglobose, c.5mm in diameter.

In Nigeria recorded as flowering September to March, fruiting November to April.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Extracts from leaves of A. cordifolia have been found to inhibit the growth of bacteria such as Staphylococcus aureus, Staphylococcus albus and Eucherichia coli (Ogunlana & Ramstad 1975). Alchornin and traces of alkaloid have been extracted from the leaves and root bark respectively (Oliver, 1959).

5. FOLK MEDICINAL USES

A slurry of the fruit when drunk cures coughs and coated tongue or a decoction of fresh leaves of A. cordifolia, Erythrina senegalensis, Abrus precatorius and ripe Musa sp. fruit when drunk is a good remedy for coughs. Instead of Musa sp., fat from meat is substituted if the patient is an infant.

Decoctions comprising a mixture of dry leaves of A. cordifolia, fresh leaves of Psidium guajava, and seven fruits (for female patients) nine (for male patients) of Xylopia aethiopica serve as a good laxative.

A decoction of leaves of A. cordifolia, Citrullus lanatus, open Xylopia aethiopica fruits and stem and leaves of Cassia tora is taken as a remedy for gonorrhea.

The liquid obtained by boiling the leaves in water is used as a remedy for fever and rheumatic pain.

The exudate of this species is applied to the eyes to remove foreign bodies. According to Oliver (1959), the leaves and bark of this plant are used locally in the treatment of eye and other diseases as well as an antifouling agent on boat hulls.

A decoction of the leafy twigs is used as an application to sore feet and as a lotion or poultice (Dalziel, 1937). The pulverised dry leaf is applied to ulcers and yaws.

6. MAJOR CHEMICAL CONSTITUTENTS AND MEDICINAL PRODUCTS

Not known so far as the plant has either folk or medicinal practical uses. (see 4.)

7. HARVESTING, CONSERVING AND PREPARATION

Collection of fruit, bark and leaves, no details of processing given by author.

8. ECONOMICS AND MARKETING

Locally marketed, no figures available.

9. SILVICS

A secondary forest species of multi-stemmed or climbing habit, naturally regenerated by seed.

10. MAJOR DISEASES

Rust Skierka congensis P. Henn was reported by Eboh (1983).

11. OTHER USES

It has been reported that in America the juice of the berry is used in the preparation of an anti-fouling coating against marine growth on ships' hulls and other metal surfaces.

The bark contains 11% tannin and the leaves 10%; both the twigs and leaves are used in Nigeria for tanning fish nets.

A black dye obtained from the plant is used in dyeing fabrics, pottery, callabashes and as an ingredient of ink.

Pipe-stems are made from the stems.

The leaves are used for wrapping cola nuts for transport over short distances.

The red fruits are used to trap birds.

The wood ash, together with that of Erythina altissima are used in indigo dyeing in Guinée. The plant is the favourite food of the situtunga antelope (Irvine, 1961).

12. BIBLIOGRAPHY

Dalziel, J.M. (1937) — The Useful Plants of West Tropical Africa. London: Crown Agents.

Eboh, D.O. (1983) — A new species of Newinia from Nigeria. Mycologia 75,2: 316-318.

Eboh, D.O. (198) — Uredinales Nigerianensis IV. Mycologia (in press).

Irvine, F.R. (1961) — Woody Plants of Ghana. London: Oxford University Press.

Oliver, B. (1959) — Medicinal Plants of Nigeria. Ibadan: Nigeria College of Arts, Sciences & Technology.

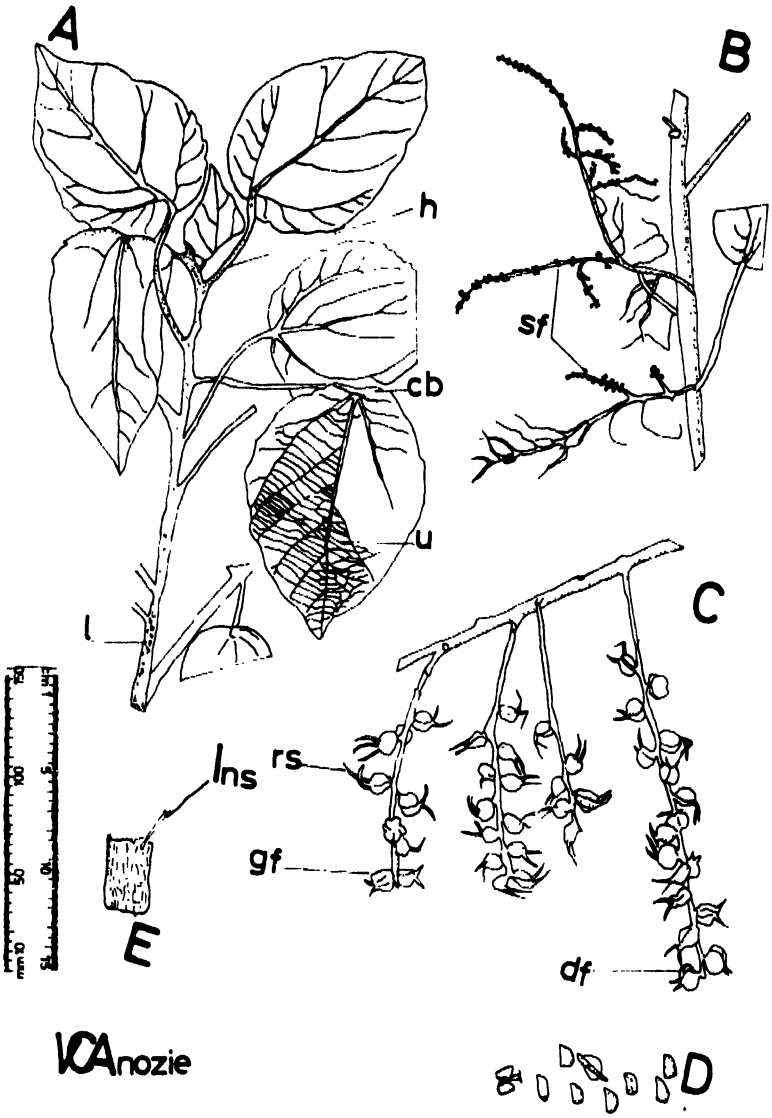


Plate II.

Alchornea cordifolia
(Schum. et Thonn.) Muell. Arg.

A. Vegetative shoot; fine hairs (h) cordate base (cb) veins (u) lenticel (l).

B. Inflorescence; small flowers (sf).

C. Fruiting twig; remains of of style (rs), greenish ripe fruit (gf), dehisced fruit (df).

D. Whole seeds.

E. Stem bark; inflorescence stalk (Ins).

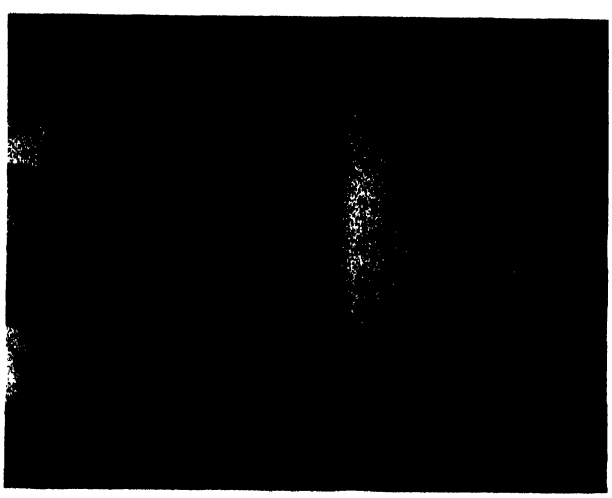


Plate II-1. Fruiting twigs of A. cordifolia

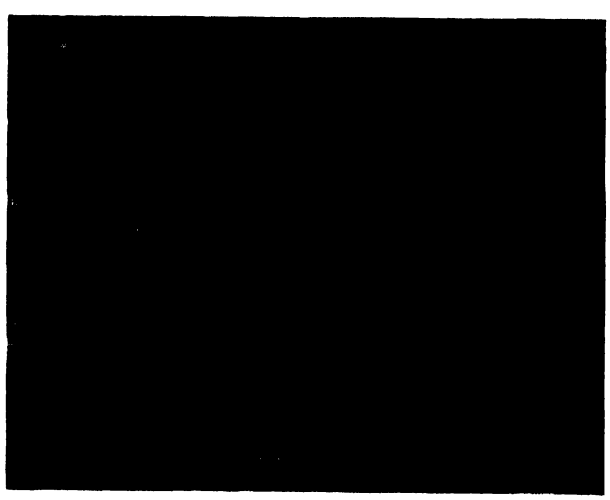
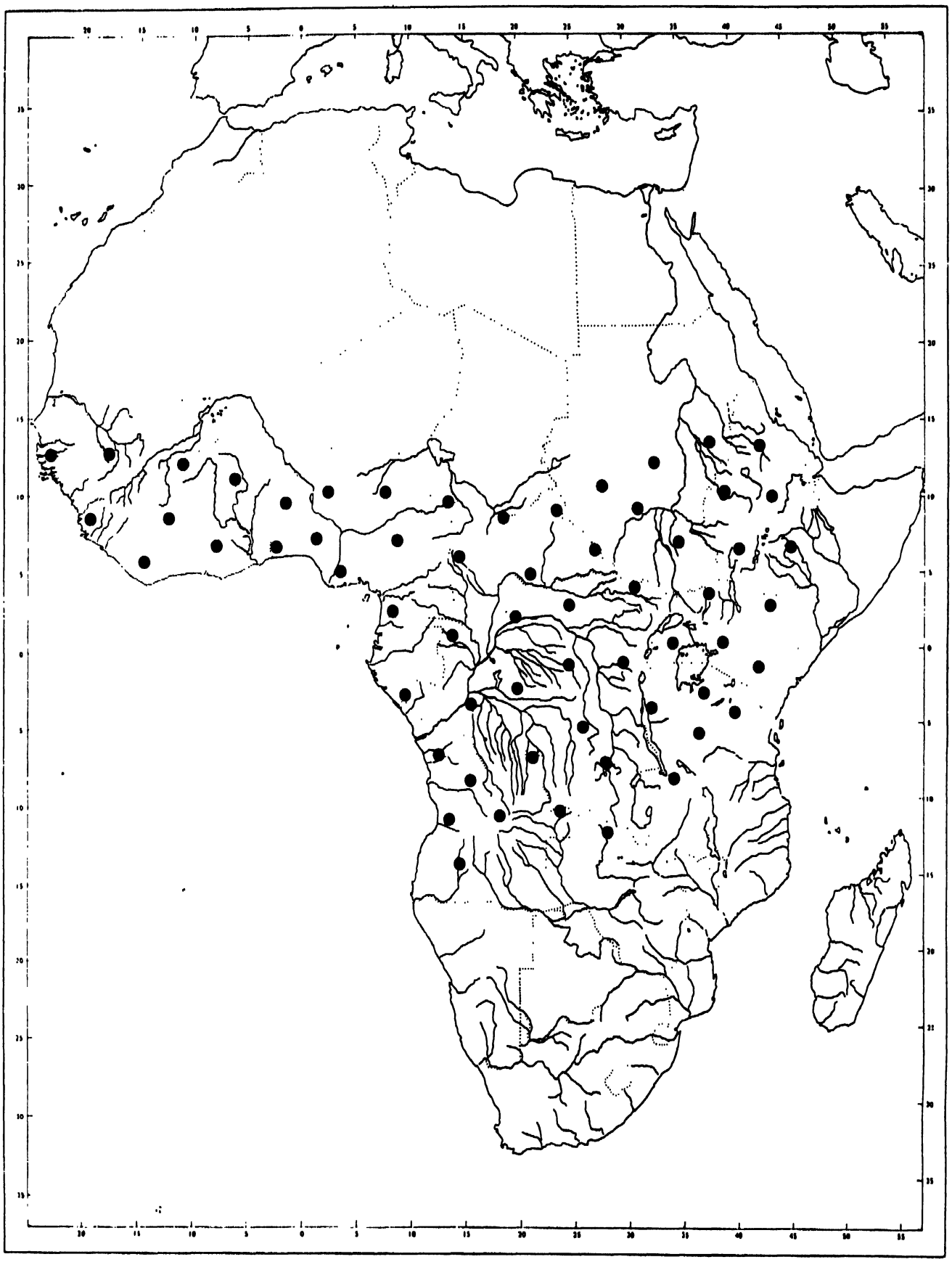


Plate II-2. leaves and fruits of A. cordifolia

MAP 2 - Geographic distribution of Alchornea cordifolia



1. BOTANICAL NAME: Alstonia boonei De Wild

SYNONYM: Alstonia congensis sensu acut. non Engler

FAMILY: Apocynaceae

COMMON NAMES: Emien (Trade name); Yung (Gio), Osen-nuri, Onyame-dua (Ashanti, Twi); Awun (Yoruba), Ukhu (Bini), Okugbe (Itsekiri, Ukpukuhu (Urhobo), Ndondo (Ijaw), Egbu (Ibo), Ukpo (Efik), Etiap (Ekoi), Bokuk (Boki), Ouguie, Sinduru (Ivory Coast), Tsonguti, Bokuka, Otando (Zaire), Myna, Mujwe (Uganda), Kaiwi (Sierra Leone), Ekouk, Kanja (Guinea), Kinjé, Kaika (Gabon) Nfomba, Ubangi, Moguga (Angola).

2. ECOLOGY AND DISTRIBUTION

In Nigeria Alstonia boonei occurs in the moist lowland forest but may extend into drier types, including gentle to even, steep, rocky hill sites in Liberia, but most commonly found scattered or in small groups in wet or marshy places that are occasionally inundated. A light demanding species (Voorhoeve 1965).

Widely distributed in northern tropical Africa, occurring in Senegal, Gambia, Guinea, Ivory Coast, Ghana, Nigeria, Cameroon, Sudan, Uganda and Cabinda (see map).

3. DESCRIPTION

A large deciduous tree, up to 45m high and 1.2m in diameter; bole often deeply fluted to 7m; bark greyish-green or grey, rough; slash rough-granular, ochre-yellow, exuding a copious milky latex; branches in whorls. Leaves in whorls of 5-8, simple, subsessile to petiolate, stipules absent; petiole 2-10(-15)mm long, stout; blade oblanceolate to obovate, rarely elliptic, 7-26cm long, 3-9.3cm wide, apex acute to rounded or sometimes emarginate, base narrowly cuneate, margins entire, subcoriaceous to coriaceous, dark shiny green above, light green below, midrib more prominent below, lateral veins 25-50, more-or-less at right angles to midrib, parellel, anastomising very close to margin. Inflorescence terminal, compound with 2-3 tiers of pseudo-umbels; primary peduncles 0.5-7cm long, greyish pubescent, bracts ovate-triangular, 1-1.5mm long, pubescent; pedicels c.0.5cm long; flowers regular, hermaphrodite, 5-merous. Calyx cupular, tube c.1mm long, lobes ovate, c.1.5mm long, spreading; corolla pale green, tube up to 14mm long, lobes slightly obliquely ovate, up to 6mm long and wide, pubescent outside; stamens 5, inserted in the corolla tube, filaments 0.5mm long; carpels 2, c.2mm long, ovules numerous, styles 2, united above the carpels. Fruit formed by 2 pendent green follicles up to 60cm long. longitudinally striate, dehiscing lengthways while on the tree; seeds numerous, flat, c.4mm long, 2mm wide, with 10mm long tufts of hairs at each end (Voorhoeve 1965).

Flowering, October to March; fruiting, December to May.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Kucera, et al; (1972) reported six alkaloids out of which two were named as echitamine and echitamidine. The two alkaloids have diuretic and hypotensive properties respectively. Voacagine - $C_{22}H_{28}N_2O_3$, akuaminide - $C_{21}N_{24}N_2O_3$ (M = 368) and two other non-defined indolid alkaloids were reported by Croquelois et al (1972) from the leaves of A. boonei. Faparusi et.al.(1980) described briefly the chemical characteristics of the aqueous extract of the bark of A. boonei and its sleeping time in the rat including a brief review of some steroids.

5. FOLK MEDICINAL USES

A cold infusion of the stem bark in palm wine with fruits of Capsicum frutensis or a decoction of stem bark of A. boonei, Khaya grandifoliola, Cleistopholia patens and some quantity of red small pepper (Capsicum frutensis) in palm wine is a remedy for malaria.

An infusion of the stem bark in cold water is drunk or used for bathing as a remedy for dizziness.

An infusion of stem bark of A. boonei and a bunch of Piper guineense fruit in local gin is drunk once daily to treat impotence. Dosage should not exceed 1 tablespoonful per day.

Breast pains are treated with native soap and bathing the affected part with extracts from young leaves of A. boonei in water.

An infusion of stem bark is drunk as a cure for worms or snake bite or also to relax muscles and as a cure for rheumatic pains.

An infusion of root and stem bark and leaves is drunk as a remedy for asthma.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Adesina (1982) in a pharmacological evaluation of extracts from A. boonei found alcoholic extract to be a depressant with sedative properties, and a moderate anti-leptaxol effect, but no antileptazol and antistrychine were isolated. Faparusi and Bassir (1972) isolated B. amyrin acetate, B. amyrenone lupeol and sitosterol.

7. HARVESTING, CONSERVING AND PREPARATION

The bark is collected locally when needed and used fresh.

8. ECONOMICS AND MARKETING

Sold in local markets.

9. SILVICS

About 1000 seeds weigh 30gm. Germination is epigeal and takes 19-25 days. Mature trees often damaged by wind and decay but coppice readily from the base (Voorhoeve 1965). Plentiful natural regeneration in secondary forests.

10. MAJOR DISEASES

Odeyinde (1977) in an assessment of wood destroying fungi in West Africa reported that the collar stump of A. boonei is attacked by the fungus, Irpex flavens.

11. OTHER USES

The wood is fine-textured, yellowish-white, light and soft; used for bowls, toys, masks, canoes, etc. Export prospects are doubtful although it has a local potential for stools, domestic utensils, light carpentry, boxes, wood wool for packing bananas, etc. Latex used as a rubber adulterant and as bird lime (Irvine 1961).

12. BIBLIOGRAPHY

Adesina, S.L. (1982) Studies on some plants used as anticonvulsant in Amerindian and African traditional medicine. Fitoterapia 1982, 5/6: 147-162.

Croquelois, G., Kunesch, N., Debray, M. and Poisson, J. (1972) Alkaloides de l'Alstonia boonei De Wild. Plantes médicinales et phytopthérapie 6,2:122.

Irvine, F.R. (1961) Woody Plants of Ghana. London: Oxford University Press.

Odeyinde, M.A. (1977) Wood destroying fungi. Forestry Research Institute of Nigeria, Ibadan: Proceedings of International Workshop on Wood Preservation : 34 p.

Faparusi, S.I., and Bassir, O. (1972) Triterpenes from Alstonia boonei. Phytochemistry 2: 3083-3084.

Fapurusi, S.I., Osiyemi, F.O. and Adekunle, A.A. (1980) A pharmacological aspect of the acqueous extract of Alstonia boonei De Wild. Rev. Brasil Biol. 40,3:639-642.

Voorhoeve, A.G. (1965) Liberian High Forest Trees. Wageningen: Centrum voor landbouwpublikaties en landbouwdocumentatie. Agricultural Research Report No. 652.

PLATE III. Alstonia boonei De Wild

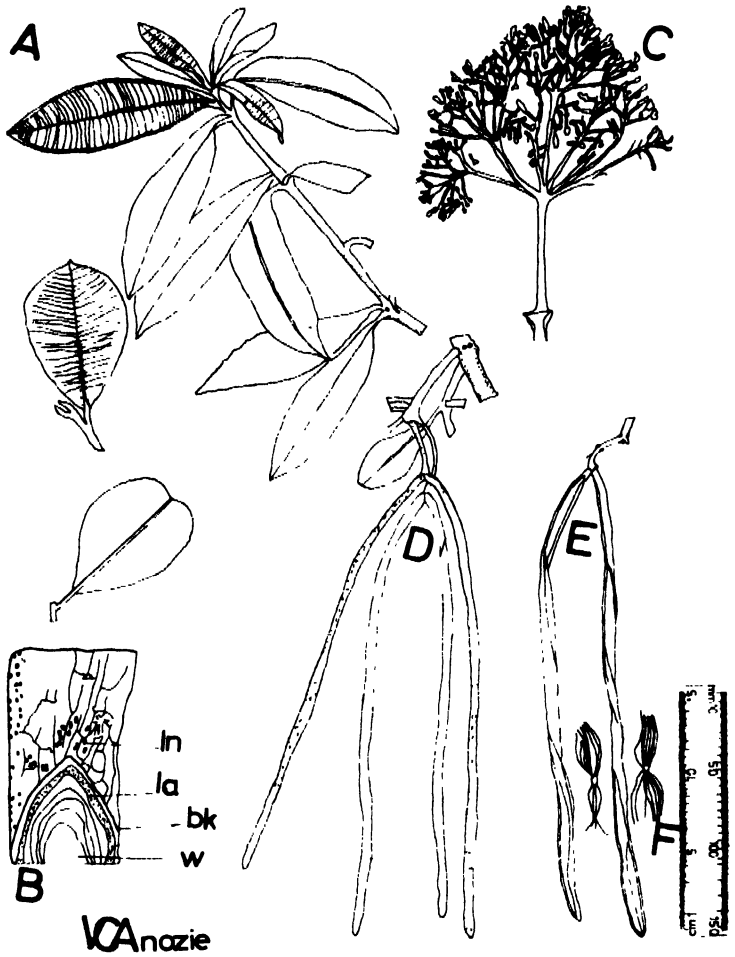


Plate III.

Alstonia boonei De Wild

A. Vegetative shoot.

B. Stem showing bark and transverse section; lichens (ln) bark (bk) white latex (la) white wood (w).

C. Inflorescence.

D. Green fruiting twig.

E. Ripe dehisced fruit.

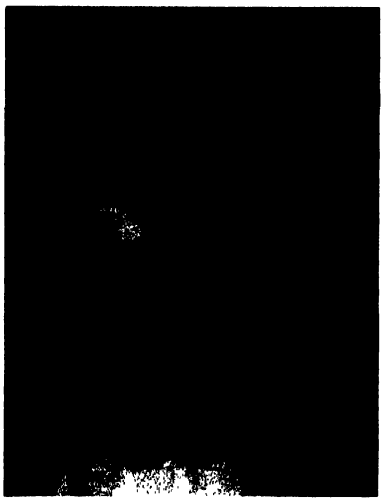


Plate III-3

Leaves of A. boonei

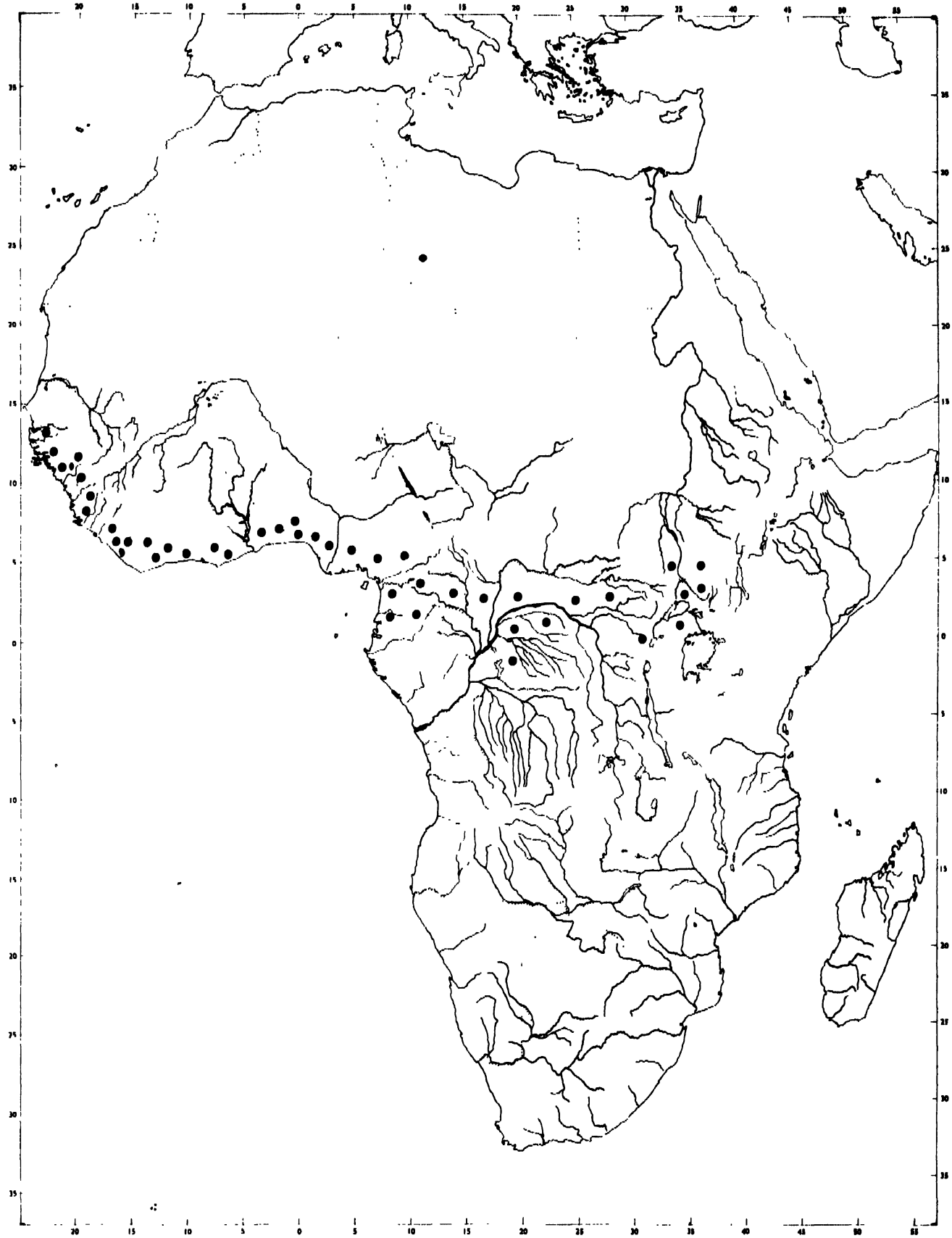
Plate III-1

Habit of mature tree of Alstonia boonei

Plate III-2

Habit of young tree of Alstonia boonei

MAP 3 - Geographic distribution of Alstonia boonei



1. BOTANICAL NAME: Anacardium humile St.Hil.

FAMILY: Anarcardiaceae

COMMON NAMES: Cajù, Cajú do campo, Cazuzinho (Brazil), Cashew

2. ECOLOGY AND DISTRIBUTION

Anacardium humile occurs on the poor, acid soils of the 'cerrado' at altitudes up to 630m. The 'cerrado' is subjected to annual fires, which may limit the growth of the cajú.

It is native to Brazil and grows in Minas Gerais and Mato Grosso and possibly elsewhere in central Brazil (see distribution map).

3. DESCRIPTION

A shrub or small tree up to 1.3m or more high; stem short and twisted, with a large xylopodium, which ensures survival after fire and drought. Leaves alternate, simple; stipules absent; petiole stout, c.5mm long; blade obovate to oblong-obovate, up to 19cm long, 8.5cm wide, apex retuse to rounded, base cuneate, margins entire, cartilaginous, rosy when young becoming greenish-yellow with age, midrib and 13-14 pairs of veins very prominent below. Inflorescence an elongated, terminal panicle 22cm or more long. Calyx lobes 5, lanceolate, 2mm long, 0.5mm wide, mealy; petals 5, pale rose or white, linear, 7mm long, 0.5mm wide, reflexed at anthesis; stamens ?10, 1 fertile with filament 7-8mm long; ovary obliquely ovoid, ovules 1, style slender, 6mm long. Fruit a smooth, grey, leathery, kidney-shaped drupe 2-3cm long, attached to and slightly immersed in an enlarged, fleshy pedicel (false-fruit) which is slightly acid but edible; seed 1, oily.

Flowering, beginning August; fruiting October to November or sometimes December.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The oil in the mesocarp, popularly known as "leite de castanha" (milk of "castanha"), contains Cardol and Anacardic acid, which give it caustic properties, and thus it is used as an antiseptic, a vermifuge, for cauterization and in the curing of calluses, warts, skin blemishes and tissues of neoformation.

5. FOLK MEDICINAL USES

There are references to the utilization of cashew, "cajú", oil in the curing of leprosy.

The inner bark, cooked, is used for rinsing the mouth and gargling for mouth ulcers and throat infections. In infusions or macerated it is used in the curing of diabetes and asthma.

The pseudo-fruit and the juice are rich in Ascorbic acid and Riboflavin. They are used to make a tonic, sedative, diuretic, in cases of poisoning, as a depurative, to improve diet, and in cases of diarrhoea.

There are indications of the pseudo-fruit and of the oil extracted from the nut being used as an antisyphilitic and in skin diseases.

The bark is used in the treatment of haemorrhages and is also well known as an anti-diabetic. The recommended does is of 4 grams of bark in 1 glass of boiling water 2 or 3 times a day. There are references to the use of the bark as an aphrodisiac when bottled and macerated in "aguardente" (Sugar cane spirits).

It is also used as a disinfectant, for the cleansing of eczemas, leucorrhea and infections of the feet. The recommended dose is of 10 grams of bark, which should be boiled for 20 minutes, then mixed with cold water and applied to the affected areas.

By cutting the trunk one gets a resin-like substance, light brown in colour,perfumed, hard, and acrid in taste. This resin when dissolved in water is used as an expectorant in cases of persistent coughing. The Indians use this resin as a powder, and it is mixed with a liquid to be taken by women whose menstrual period did not occur (Braga, 1960).

6. MAJOR CHEMICAL CONSTITUTENTS AND MEDICINAL PRODUCTS

The cashew and seeds, the "castanha", are high in nutrients, for they are composed of approximately 9.7% of azotic substances, 5.9%of starch, 14.13% of fine yellow oil the density of which is 0.916 (Hoehne, 1979).

The pseudo-fruit is a source of Ascorbic acid and Riboflavin while the oil in the mesocarp contains Cardol and Anarcardic acid.

7. HARVESTING, CONSERVING AND PREPARATION

No details available but processing is indicated in section 8.

8. ECONOMICS AND MARKETING

The importance of this species lies in the commercialization of its fruit and pseudo-fruit. The fleshy pedicel is greatly in demand in the juice and sweetmeat industry as well as "in nature", for it is tasty and refreshing. The oil can be extracted from the real fruit, the "castanha", and has many different uses. The roasted seed is also commercialized and is used as an aperitif or snack. Vinegar, liquor, wine and "aguardente", (liquor distilled from natural fermentation products of sugar cane), can also be derived from the juice of the peduncle.

The wood is considered to be of poor quality and produces a great deal of ash when burned.

The astringent peel is used for tanning processes.

With the sour cashews, "cajus", the peel is utilized for dyeing clothes, hammocks and fishing lines, giving them greater resistance due to the presence of tinctorial substances.

The resin which leaks from the trunk has the same uses as gum arabic and is preferred by bookbinders because it is cheaper and more resistant.

9. SILVICS

The seed germinates rapidly, and soon reaches the full stature of an adult tree, beginning fruit production in 2 years. Anacardium humile St. Hil, being well adapted to the soils beneath the "cerrado" vegetation, is often suitable as rootstock for grafting of other varieties which are more susceptible to disease, and which donot occur spontaneously in acid soils. Genetical improvement studies are needed for this species.

10. MAJOR DISEASES

None specified.

11. OTHER USES

The resin from the tree is thick and dark in colour and is used as a varnish, to waterproof wood, and as a polish for furniture. The natives in Brazil make flour and also feed cattle and domestic birds with the leftovers of the pseudo-fruit.

12. BIBLIOGRAPHY

Barros, M.A.G. e (1982)	Flora Medicinal do Distrito Federal. Brasil Florestal, Brazil 12(50):35-45
Barroso, G.M. (1978)	Sistemática de Angiospermas do Brasil. Livros Técnicos e Científicos Ed. S.A./Ed. da Un. de S. Paulo. Volume I. S. Paulo. 255 p.
Braga, R. (1960)	Plantas do Nordeste, especialmente do Ceará. 2a. Ed. Imprensa oficial do Ceará, Fortaleza - Brasil. 540 p.
Carvalho, R.F. (1976)	Alguns dados Fenológicos de 100 espécies florestais, ornamentais e frutíferas, nativas ou introduzidas na Eflex de Saltinho, PE. Brasil Florestal, Brasília, DF. 7(25): 42-44.
Chiriani, C.H.B. (1974)	La Vuelta a los vegetales. Copyright by Libreria Hachette 5.A. Argentina. 631 p.
Conceiçao, M. (1980)	As plantas medcinais no ano 2000. Tao Livraria e editora. 152 p.
Correia, M.P. (1926-1969)	Dicionário das Plantas Úteis do Brasil e das Exóticas Cultivadas. Rio de Janeiro. Imprensa Oficial. IBDF. Rio de Janeiro, Brasil. 6 v.
Cruz, G.L. (1982)	Dicionário das Plantas Úteis do Brasil. Ed. Civilização Brasileira S.A. Rio de Janeiro. Brasil. 599 p.
Ferreira, M.F. (1980)	Plantas Portadoras de Substâncias Medicamentosas de Uso Popular, nos Cerrado de Minas Gerais. Inf. Agropecuário. Belo Horizonte. 6(61): 19-23.

Gottlieb, O.R. (1982) Ethnopharmacology versus chemosystematics in the search of biologically active principles in plants. J. Ethnopharm. 6(2):227-238.

Gurgel, F.O. de, Morais, J.L., Gurgel-Garrido, L.M. (1982) Espécies Nativas Euxilóforas. In Anais do Congresso Nacional sobre Essências Nativas. Inst. Florestal. São Paulo, Brasil. Vol. 16A(2):890-894.

Hoehne, F.C. (1978) Plantas e Substâncias Vegetais Tóxicas e Medicinais. Departamento de Botânica do Estado de S. Paulo. Ed. Novos Horizontes, São Paulo. 355 p.

Hoehne, F.C. (1979) Frutas Indígenas. Instituto de Botânica, Secretaria da Agricultura Indústria e Comércio, S. Paulo, Brasil. 88p.

Kirkbride, M.C.G. de (1981) A Preliminary Phylogeny for The Neotropical Rubiaceae. Pl. Syst. Evol. Springer Verlag, Áustria. 141, 115-122.

Lainetti, R. and Brito, N.R.S. (1979) A Cura Pelas Ervas e Plantas Medicinais Brasileiras. Ed. Ouro. DF, Brasil. 169 p.

Lewis, W.H. and Elvin Lewis, M.P.F. (1977) Medical Botany. Wiley & Sons. N.Y. 515 p.

Manieri, C. (1970) Madeiras brasileiras, características gerais, zonas de maior ocorrência, dados botânicos e usos. São Paulo Inst. Florestal. 109 p.

Nogueira, J.C.B. (1977) Reflorestamento heterogêneo com essências indígenas. Bol. Téc., S. Paulo 24, 1-77.

Nogueira, J.C.B., Siqueira, A.C.M.F., Morais, E. and Zandarin M.A. (1982) Plantio de Cabreuva - Myroxylon peruiferum L.F. em diferentes espaçamentos. In Anais do Congresso Nacional sobre Essências Nativas. Inst. Florestal. S. Paulo. Vol. 16A: (2): 1064-1069.

Paula, J.E. de and Heringer, E.P. (1978) Estudo anatômico de Anacardium curatelifolium St. Hil. com vistas a sua forma e às bolsas oleíferas. Brasil Florestal. Brasília, Brasil. 34,33-39.

Paula, J.E. de (1981) Estudo das estruturas internas das madeiras de dezesseis espécies da Flora Brasileira visando o aproveitamento econômico para produçao de álcool, carvao, coque e papel. Brasil Florestal II (47): 23-50.

Paula, J.E. de (1982) Espécies nativas com perspectivas Energéticas. In Anais do Congresso Nacional sobre Essências Nativas. Inst. Florestal. S. Paulo. Vol. 16A (2): 1259-1316.

Ratter, J.A., Richards, P.W., Argent G., and Gifford, D.R. (1977) Observações adicionais sobre o cerradão de solos mesotróficos no Brasil Central. In IV Simpósio Sobre o Cerrado. S. Paulo. p. 303-316.

Ratter, J.A. (1980) Notes on the vegetation of Fazenda Água Limpa. Royal Botanic Garden, Edinburgh, Scotalnd. 111 p.

Rizzini, C.T. (1971) Árvores e madeiras úteis do Brasil. Manuel de Dendrologia Brasileira. Ed. Edgard Blücher Ltda. Ed. da Univ. de Sao Paulo. S. Paulo. 294 p.

Rizzini, C.T. and Mors, W.B. (1976) Botânica Econômica Brasileira. EDUSP, E.P.U. São Paulo. 207 p.

Salomão, A.L.F. and Silva, L. da L. (1982) Angico Vermelho. Brasil Florestal. IBDF, Brasília, D.F. 10(41): 45-50.

Tortorelli, L.A. (1956) Madeiras & bosques argentinos. Ed. ACME S.A.C.I. 910 p.

PLATE IV. Anacardium humile St. Hil.

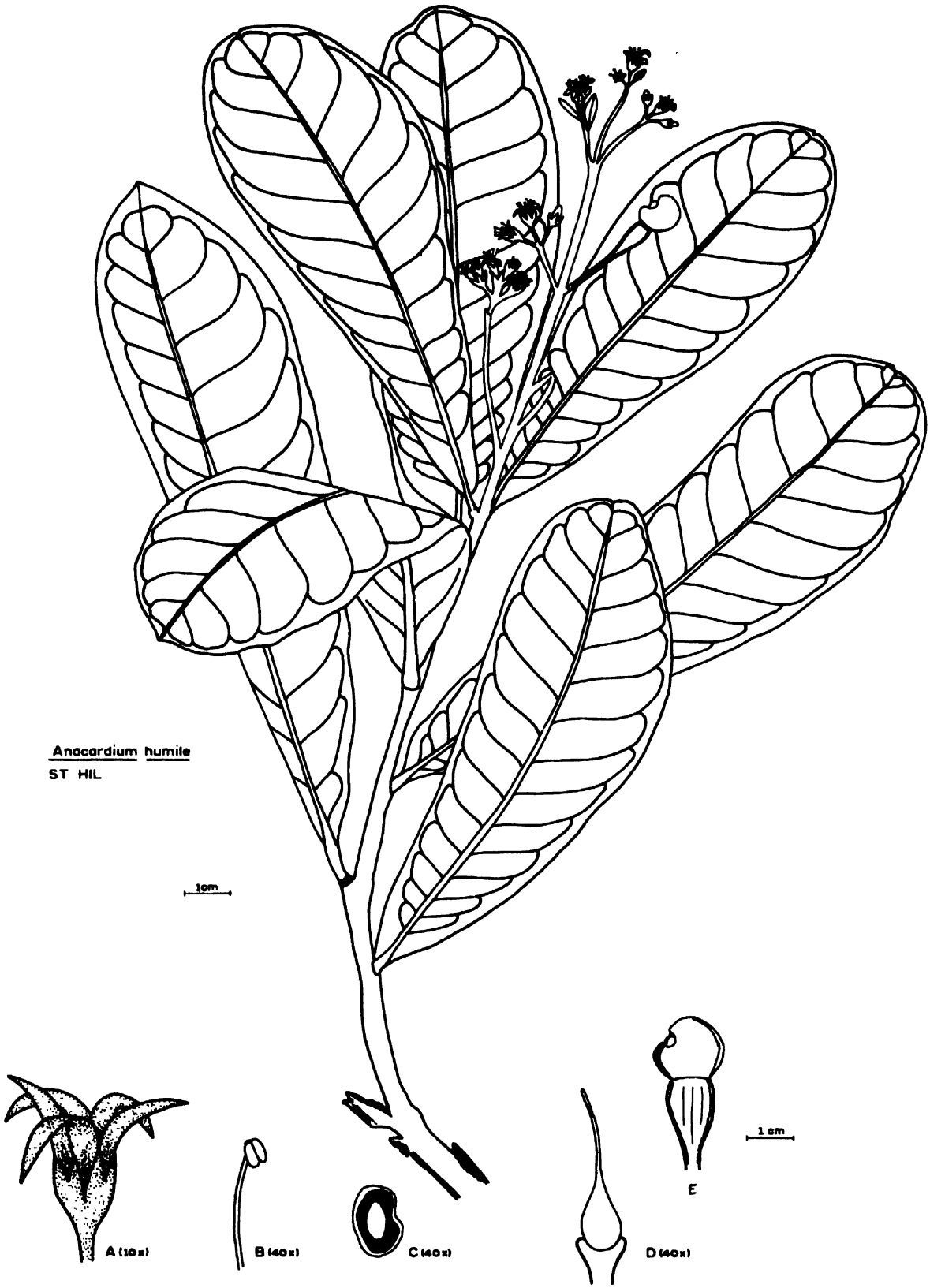


Plate IV. Anacardium humile St. Hil.

a) flower; b) androecium; c) cross section of ovary; d) gynaceum; e) fruit. (From Ratter, J.A. et al. exsiccate 2586 and 1130 UB)

MAP 4 - Geographic distribution of Anacardium humile St. Hil.

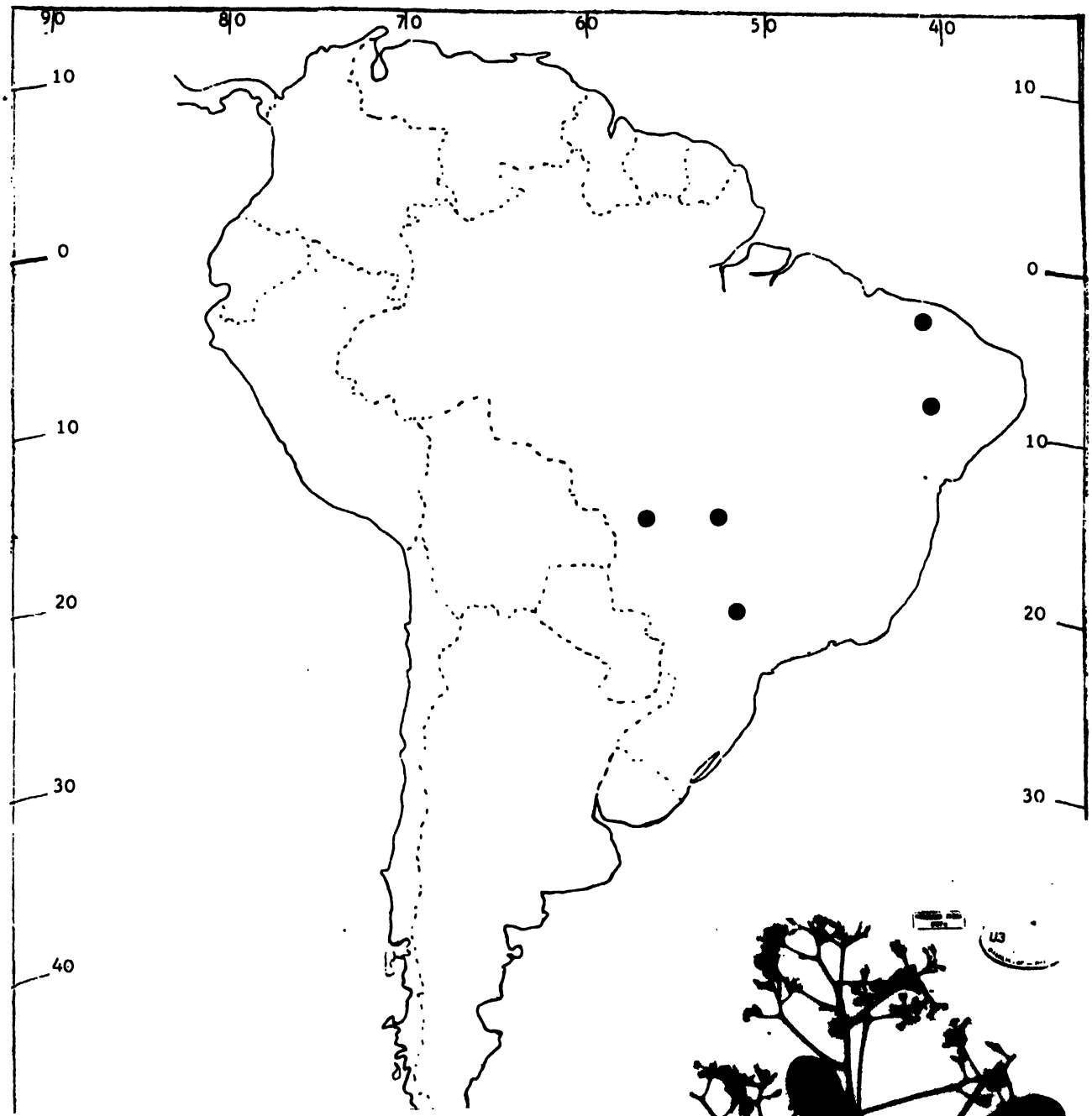


Plate IV-1

herbarium specimen
University of Brasilia

1. BOTANICAL NAME: Anadenanthera colubrina (Vell.)Brenan var. cebil (Griseb.)Altschul

SYNONYMS: Piptadenia macrocarpa Benth.
Piptadenia microphylla Benth.
Anadenanthera macrocarpa (Benth.)Brenan

FAMILY: Leguminosae subfamily Mimosoideae

COMMON NAMES: Angico, Angico do cerrado, Angico do campo. Angico vermelho (central Brazil), Arapiraca (eastern Brazil), Paricâ (Amazonian Brazil); Acàcia virgem, Acàcia angico, Cambui, Anchico, Guarapiraca, Brinco de saqui, Curapay-rà (Argentina); Cebil blanco, Cebil colorado, Curupcey

2. ECOLOGY AND DISTRIBUTION

Anadenanthera colubrina var. cebil occurs in the caatinga of north eastern Brazil, the cerrados and dry woods of central Brazil and the seasonal deciduous forests from Maranhao to Sào Paulo, and in the drier, low-mountain forest vegetation types of the Serra da Mantiqueira plateau. It is frequently found in riparian sites and is sometimes cultivated.

Its distribution extends from north eastern Brazil to northern Argentina, Peru, Bolivia and Paraguay (see distribution map).

3. DESCRIPTION

Deciduous tree, 7-30m high, depending on environmental conditions; trunk straight, up to 25cm in diameter, often covered with large, warty, woody protuberances when young which are apparently absent on older trees; bark grey-brown, longitudinally striate or fissured, exuding a yellowish resin when cut; crown attractively spreading and rounded. Leaves alternate, bipinnate; stipules bristly, soon falling; petiole and rachis 10-30cm long, petiole with a conspicuous, elliptic, nectarial gland, c.2-3mm long on upper side, the distal end of the rachis frequently bearing a similar gland; pinnae opposite, up to 30 pairs, 3-8cm long, rachie narrow, usually pilose, each bearing 50-60 pairs or ± contiguous, linear leaflets 3-6mm long, c.1mm wide, dull or bluish-green, glabrous or sparsely pilose, petiolules short. Inflorescence a spreading panicle of spherical, many flowered capitula c.10-15mm in diameter, on short side shoots along the upper leaves; flowers bisexual, creamy-yellow or white, sessile. Calyx shortly 5-lobed; corolla tubular, c.2mm long, with 5 deltoid teeth; stamens 10, filaments 5-8mm long, anthers with a small deciduous apical gland. Fruit a torulose, flattened pod 15-32cm long, 2-3cm wide, dark brown, horny and slightly rugose, dehiscing along one suture only; seeds several, flattened, disc-shaped, 1.5-2cm in diameter, glossy dark brown with small hilum.

Flowering from August to September in Central Brazil, and October to January in north eastern Brazil; fruiting July to August in Central Braxil and November to March in north eastern Brazil.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The astringent properties of the Anadenanthera bark have been long used as a popular medicine due to the content of bufotenine, which is the active ingredient. It is a hallucinogenic substance and its action has been scientifically tested in allopathic medicine.

5. FOLK MEDICINAL USES

The bark is the part of the tree most used in folk medicine. A decoction of grated bark is taken for liver complaints. Two spoonsfuls (10 grams) of grated bark is added to two cups of boiling water. The mixture is removed from the heat and allowed to soak for 20 minutes. It is taken warm twice a day.

A syrup made from the bark and resin is taken for bronchitis and quinsy. A decoction of the bark is taken as a cure for gonorrhea, leucorrhea and as a depurative for the blood. 30 grams of bark are boiled in 5 cups of water for 5 minutes. It is allowed to cool and is drunk 2 to 3 times a day. Alternatively, pieces of bark (50 grams) are added to a litre of white wine or sugar cane spirit. It is left to stand for a month and then taken 3 times a day, after meals.

A decoction of the bark and resin is used for gargling as a cure for pyorrhea, while a decoction of bark is used for washing to treat leucorrhea and ovarian infection.

A snuff made from the seeds is taken in small quantities as a cure for headaches, colds and coughs. The seeds are dried in the sun then roasted and grated.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

No details available but evidently has a high tannin content.

7. HARVESTING, CONSERVING AND PREPARATION

No details available.

8. ECONOMICS AND MARKETING

No details available. The bark and resin are collected and used locally.

9. SILVICS

No details available but presumably can be propogated from seed.

10. MAJOR DISEASES

None specified.

11. OTHER USES

The species is a rapid producer of biomass. The first rotation occurs in about 6 years. The species is used as lumber. It is a rough hardwood, very heavy, inflexible and of great durability. It is excellent for the production of alcohol, charcoal, coke and firewood, (Paula, 1981).

N.B. In Riauí, north eastern Brazil, the leaves and flowers are reputed to be highly toxic when used as forage between November and January, but are eaten at other times of the year.

It is used in pharmacology due to its high content of oils, essences, and tannins. The wood is utilized for planks, wooden frameworks, rural construction, rafters, window frames, doorposts, floor tiles, railway sleepers, sugar mill wheels, and furniture because of the dark red stripes in its heartwood. This wood is not recommended for outdoor use.

The bark contains 15-32% of tannin and is used a great deal in tanning; it also contains resinous gum, which is utilized in industry for the manufacture of glue and medicine.

12. BIBLIOGRAPHY

Paula, J.E.de (1981) — Estudo das estruturas internas das madeiras de dezesseis espécies da Flora Brasileira visando o aproveitamento econômico para produçao de álcool, carvao, coque e papel. Brasil Florestal II (47): 23-50.

PLATE V. Anadenanthera colubrina (Vell.)Brenan var. cebil (Griseb.)Altschul

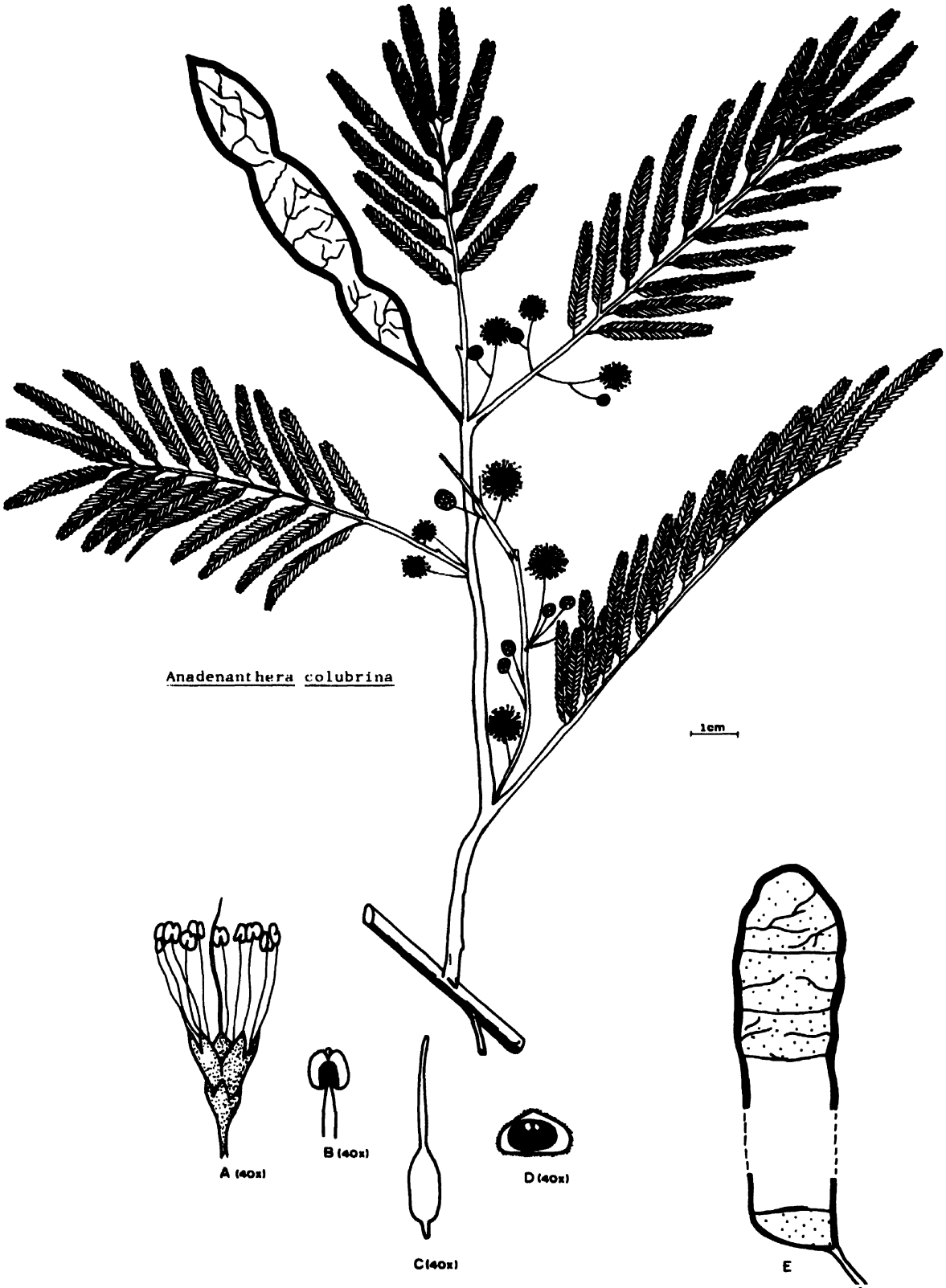
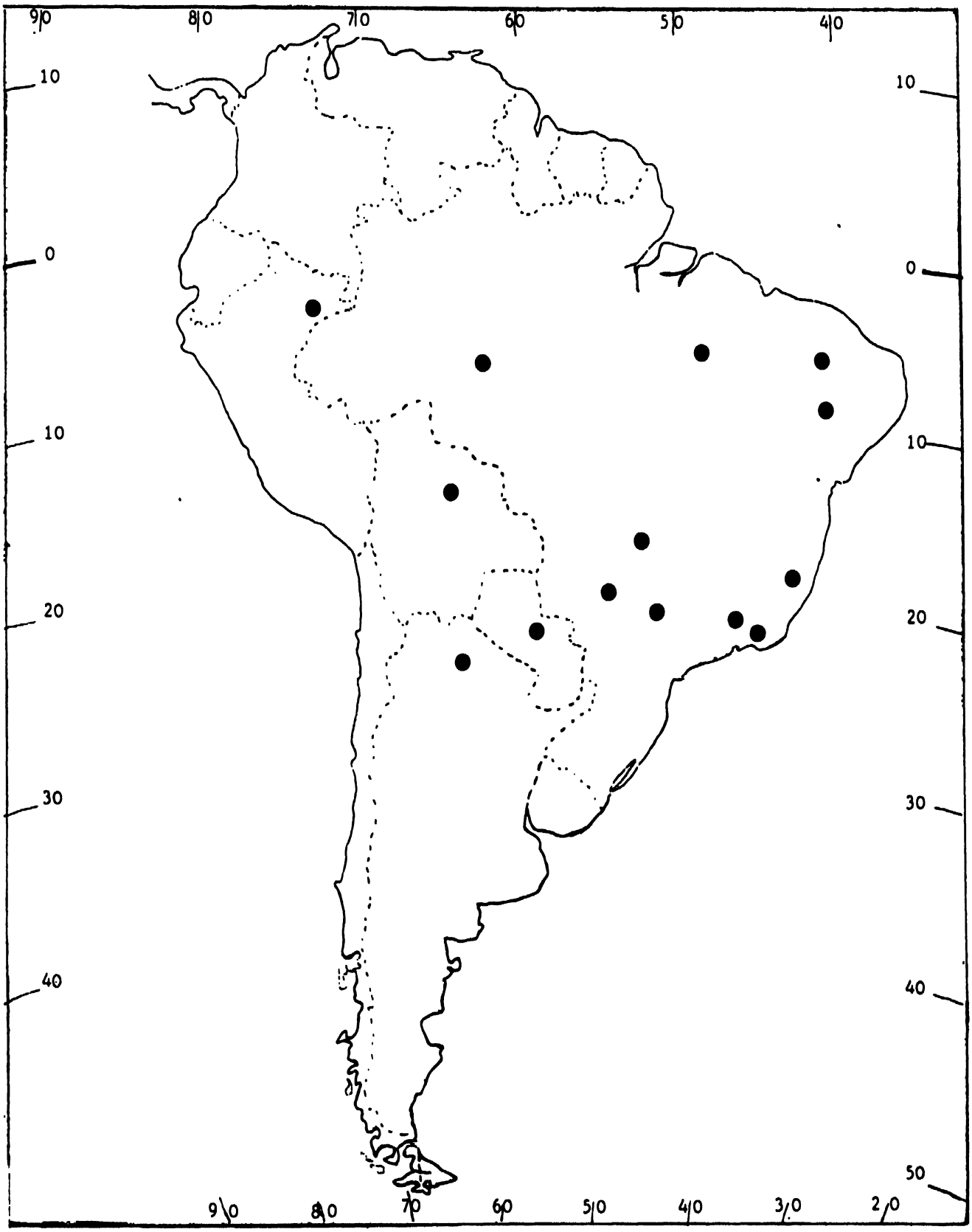


Plate V. Anadenanthera colubrina (Vell.) Brenan var. cebil (Griseb.) Altschul

(a) flower; (b) detail of anther; (c) gynoecium; (d) cross section of ovary (e) fruit.

(From Ratter, J.A. et al. exsiccates 1079 and 2653 UB)

MAP 5 - Geographic distribution of Anadenanthera colubrina



1. BOTANICAL NAME: Anthocleista nobilis G.Don

FAMILY Loganiaceae

COMMON NAMES: Cabbage Palm, Cabbage Tree; Hororoho (Fante); Awudifoakete, Bontodi (Twi, Ashanti, Wasaw).

2. ECOLOGY AND DISTRIBUTION

Anthocleista nobilis is a lower canopy tree occurring in transitional and secondary forests. On the whole it is sparsely but fairly evenly distributed, even in the drier parts of the semi-deciduous forests (see distribution map). It is common however in forest clearings. It is often left standing on farms because of its medicinal properties.

It prefers well-drained soils and a rainfall of between 1100mm and 2000mm and a termperature not exceeding 35°C. It generally prefers low lying ground not exceeding 300m above sea level but can occur up to 1200m.

It is a West African species found in Senegal, Guinea, Sierra Leone, Liberia, Ivory Coast and Ghana (see distribution map).

3. DESCRIPTION

A tree up to about 18m high, 15-45(-90)cm in diameter, bark smooth, light grey, slash cream-yellow and granular; bole free of branches for up to 15m, crown small with ascending, hollow branches, twigs with two divergent spines above the leaf axils. Leaves crowded at the apices of the branchlets, opposite, subequal, sessile or shortly petiolate; petioles up to 1/6th as long as the blade; blade oblong-elliptic, obovate-elliptic or oblanceolate, up to 6.5-40cm long, 4-12cm wide, larger on young trees, discolorous, dark green above, glaucous below. Inflorescence erect, branched, terminal cymes, 12-60cm long, borne on conspicuously long peduncles; flowers hermaphrodite, 4-merous; sepals orbicular to ovate-elliptic, 7-10mm long, 4.5-13mm wide; corolla white, tubular, fleshy, 30-45mm long with 11-14 oblong lobes; stamens attached to the corolla tube and protruding. Fruits ellipsoid berries 2-2.5cm in diameter with persistent calyx; seeds numerous, dark brown, obliquely ovate-orbicular, 2-2.5mm long, 1.2-1.7mm wide. (Leeuenberg, 1961).

Flowering and fruiting cycle uncertain; flowering specimens have been recorded for most months of the year.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

An antidiabetic, hypoglycaemic effect of an alcoholic extract from the root bark of Anthocleista nobilis on the blood sugar is reported. The active principles and its chemical structure is in the process of elucidation.

Dual activity (hypotensive and hypoglycaemic) may be valuable in the therapeutics of obese adult diabetics who usually present hypertension clinically (Lutterodt, 1976).

At Mampeng Akwapim the root is reported to be an effective remedy for diabetes (Centre for Scientific Research into Medicinal Plants). The root decoction is used as a purge for fever (Dalziel, 1936).

The plant (mainly the bark) is commonly prescribed in the Ivory Coast when violent action on the intestines is desired (Kerharo and Bouquet, 1960).

A plant which is commonly used in Gabon and West Coast medicines (Abbé Walker, 1953).

The bark is an ingredient in remedies for several diseases (Abbé Walker, 1953).

5. FOLK MEDICINAL USES

In Ghana, the bark is boiled with water and the liquid extract taken once a day for the cure of piles, intestinal and abdominal troubles and worms. The same prescription, sometimes mixed with the bark of Merinda lucida is drunk as a purgative for jaundice in Akwapim. The root bark mixed with red pepper, ginger and guinea grain (Piper) is used by the Fantis as an enema for hernia (traditional medicine).

The roots steeped and mixed with guinea grain and pepper are used in the Central African Republic for piles.

The bark infusion after exposure to the sun in an open bottle is used in the Central African Republic for gonorrhoea, and the bark decoction is used there in enemas and sitz baths for colic and stomach troubles. The bark decoction is drunk or used in bath and vapour bath, as an antidote to poisoning and also for leprosy, gonorrhoea, menstrual troubles or as a purgative.

The pulped bark is used an enema for Oxyuris (thread worm) and other intestinal parasites in children.

The young green shoots are powdered and used in the Central African Republic for ulcers (Abbé Walker, 1953).

The leaf is a woman's medicine in Sierra Leone. A leaf decoction is taken with lemon for abdominal pains of uterine origin (Dalziel, 1936).

For birth control of family planning, the bark of Anthocleista nobilis together with those of Bosqueia angolensis and Spathodea campanulata are boiled and a dose taken internally once a week. Part of the liquid is also applied as enema (Ghana Traditional medicine).

6. MAJOR CHEMICAL CONSTITUTENTS AND MEDICINAL PRODUCTS

The bark contains two alkaloids "Brucine" and "Loganine" (Kerharo and Bouquet, 1960).

Though it is not considered poisonous by Africans, Ivanoff states that it has caused accidental poisonings resulting in bad colic, obstinate constipation, weakening of the stomach (or spasm of pylorus), fibrillary trembings, pronounced pallor and heart weakness (Kerharo and Bouquet, 1960).

7. HARVESTING, CONSERVING AND PREPARATION

The leaves are collected from young trees or where necessary by climbing. The bark is obtainable by slashing or peeling with a cutlass. The collected parts are then dried in the sun and kept in wrappers or pounded and made into balls.

Native Doctors or herbalists usually prescribe boiling the roots or bark of Anthocleista nobilis with water to extract the medicinal properties, but Lutterodt (1976) extracted his medicine with alcohol. At Mampong Akwapim the plant-materials are sometimes powdered and doses administered in conjunction with cereal pap.

8. ECONOMICS AND MARKETING

Dried bark and roots are sold in markets. The timber is of some value.

9. SILVICS

Anthocleista nobilis regenerates itself successfully in its natural habitat, but no attempt has been made to grow the tree artificially in Ghana. It may be propagated by seeds. It thrives in open places.

10. MAJOR DISEASES

None have been recorded in Ghana.

11. OTHER USES

The wood is creamy white, light and soft. It works easily and finishes smoothly but it is perishable.

It is suitable for general carpentry and for ply-wood. In Liberia it is used for leopard traps (Cooper,). The hollow stem is used for quivers in Nigeria (Thornewill, Herb Oxf). The leaf ashes, with those of banana skins, are used in local soap making (Irvine, 1961).

12. BIBLIOGRAPHY

Atta Agyeman, E. (1980) Sixty seven selected illnesses and their herbs as approved by the Ghana Psychic and Traditional Healing Association.

Daziel, J.M. (1936) The useful plants of West Tropical Africa. London: Crown Agents.

Irvine, F.R. (1961) Woody plants of Ghana. London: Oxford University Press.

Keay, R.W.J., Onochie, C.F. and Standfield, D.P. (1960) Nigerian Trees. Vol. 1. Lagos: Federal Government Printer.

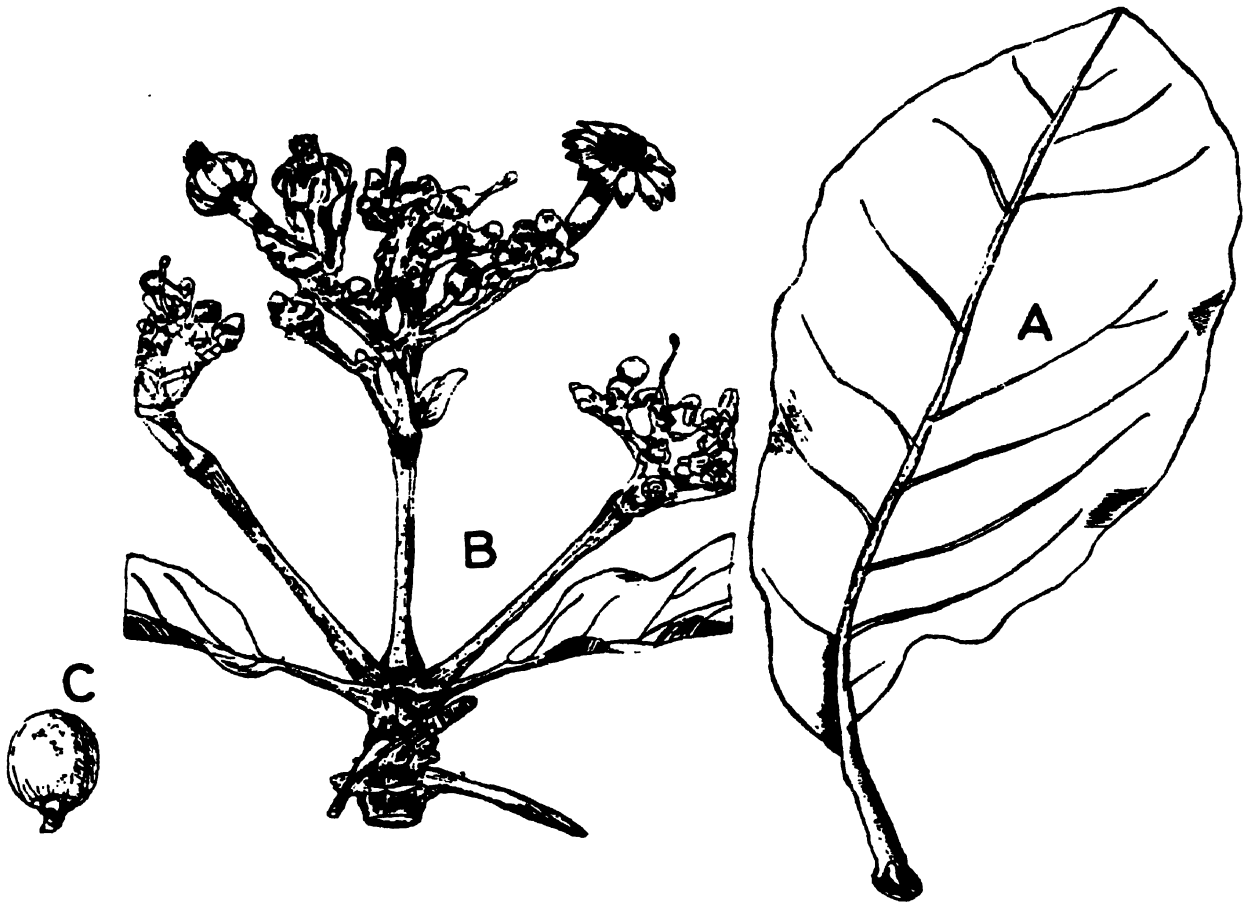
Kerharo, J. and Bouquet, A. (1960) Plantes médicinales et toxiques de la Côte d'Ivoire - Haute-Volta. Paris: Vigot édit.

Leeuwenberg, A.J.M. (1961) The Loganiaceae of Africa. 1. Anthocleista. Acta Bot. Neerl. 10: 1-53.

Lutterodt, G.D. (1976) Hypoglycaemic effect of an extract from Anthocleista nobilis. 10th Biennial Conference of the West African Science Association, Freetown, Sierra Leone (29th March - April 2nd 1976). Ghana Sci. Abstr. 2,1:

Walker, Abbé A. (1953) Usages pharmaceutiques des plantes spontanées du Gabon. Bull. Inst. Etudes centraf. N.S.

PLATE VI. Anthocleista nobilis G. Don



ANTHOCLEISTA NOBILIS

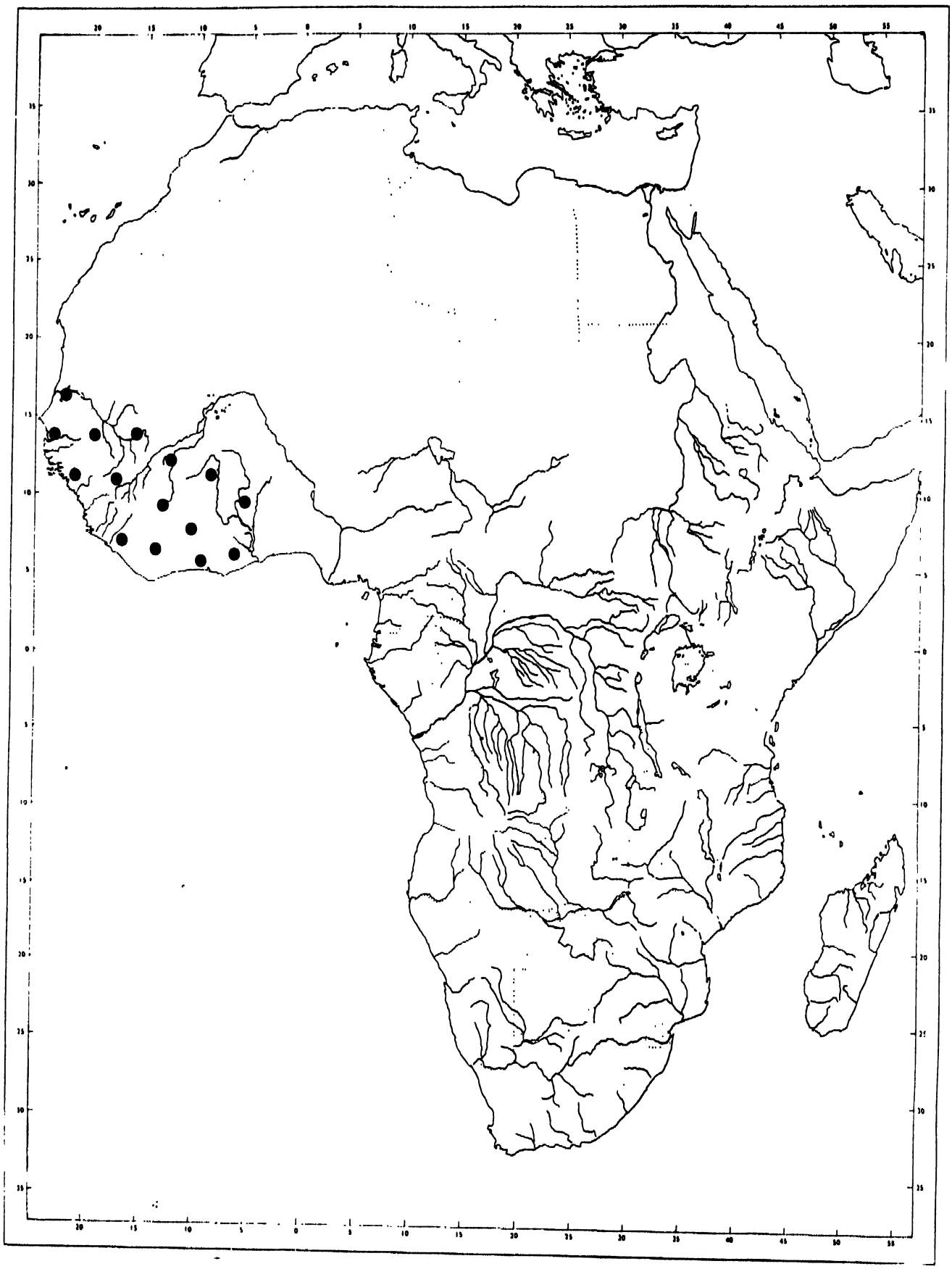
A' Leaf B' Flowering shoot C' Fruit

Plate VI. Anthocleista nobilis G. Don

(Drawings after Keay et al., 1960)

Plate VI-1. Standing tree of Anthocleista nobilis in Ghana

MAP 6 - Geographic distribution of Anthocleista nobilis



1. BOTANICAL NAME: *Artemisia afra* Jaca.

SYNONYMS: Nil

FAMILY: Compositae

COMMON NAMES: Fivi (Kisambaa); Lusanje (Kinyakyusa); Lunyaga (Kisafwa).

2. ECOLOGY AND DISTRIBUTION

Artemisia afra is a clump-forming perennial herb of the highland areas of eastern and southern Africa at altitudes ranging between 1500m and 2500(-3000)m. The soils range from volcanic ash, loamy sands to sandy or calcareous clay loams of volcanic or granitic origin.

The climatic data for meteorological stations in Tanzania where the species occurs are given in Tables 1 and 2 below.

Station	Observation Period (Years inclusive)	Mean Annual Rainfall (mm)	Annual Rainy Days
Mbeya Met.	1931-1975	932 ± 152	114 ± 14
Tukuyu District Office	1931-±1973	2340 ± 649	149 ± 59
Njombe	1931-±1973	1054 ± 250	98 ± 24
Mgamba Forest	1961-±1973	962	99
Shagayu Forest	1965-1977	1009	89

Table 1. Selected meteorological stations where *A. afra* grows naturally (after Nshubemuki *et al.* 1975).

Station	Observation	Mean Temperature			Relative Humidity	
		Max.	Min.	Mean	06.00GMT	12.000GM
Mbeya Range	1963-1969	18.7	9.0	9.7	73	70
Njombe Wattle Estate	1951-1970	21.9	10.2	11.7	93	63

Table 2. Mean annual temperature and relative humidity for selected stations (E.A. Met. Dept. 1975).

Common associate tree species of the dry montane forest and grassland where A. afra occurs include Juniperus procera, Hagenia abyssinica, Catha edulis, Polyalthia fulva, Parinari excelsa, Syzygium cordatum, Myrica salicifolia, Cussonia arborea, Psiadia arabica, Cassia floribunda, Ehretia cymosa, Turraea robusta, Euclea divinorum, Phillipia benguelensis, Erica arborea and Rumex usambarensis.

The species occurs in Zaire, Ethiopia, Uganda, Kenya, Tanzania, Zambia, Zimbabwe, Malawi, Angola and South Africa (see distribution map).

3. DESCRIPTION

A much-branched woody perennial herb 1-2m high, shortly rhizomatous; stem ribbed, smelling strongly of wormwood. Leaves alternate, bipinnatisect, stipules absent; blade grey-green, aromatic, more or less oval in outline, about 6cm long, ultimate segments linear, about 2mm long. Inflorescence an elongated racemose panicle; capitula small, 3-4mm in diameter, nodding with an involucre consisting of many rows of ovate bracts; receptacle flat, naked; florets pale yellow tubular, few outer female, inner bisexual. Achenes cylindrical, pappus absent.

In Tanzania A. afra flowers between March and July, producing seeds from August to November - i.e. flowering starts at the onset of the long rains and extends towards the beginning of the short rains.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Chabra (Pers. Comm.) observed that A. afra contains santonin, thujone, umbelliferone, and some polyacetylinic. Watt and Breyer-Brandwijk (1962) argues that A. afra contains no santonin. However, they observed that 0.5 per cent of a volatile oil with a camphoraceous odour was isolated by Godson (Godson, 1922). He also isolated a wax ester (probably ceryl cerotate), triacontane, scopoletin and quebrachitol. Cineole has been detected in the plant.

5. FOLK MEDICINAL USES

Kokwaro (1975) reports that a fermentation of the heated herb is given to children with a sore throat, also to cure fever. The plant is also used for indigestion. Roots are boiled and the decoction drunk 2-3 times a day for intestinal worms. The leaves are chewed and juice swallowed as an emetic. Chabra (Pers. Comm.) observed that A. afra is used as an anthelmintic particularly for the expulsion of roundworms and threadworm.

Harjula (1980) found out that a handful of the leaves is boiled to make a dose of somewhat more than half a litre; the dose may be repeated after 2 days if necessary for cure of stomach diseases. Roots are cleaned, dried and boiled to form a decoction which is also used for remedy of stomach diseases.

Watt and Breyer-Brandwijk (1962) reports that a decoction or infusion of A. afra is a medicine for bronchial troubles. It is used for coughs and colds, chills, dyspepsia, loss of appetite, stomach-ache and other gastric derangements, colic, croup, whooping cough; gout and as a purgative. The infusion or decoction is also used as a lotion to bathe haemorrhoids; as a hot bath to bring out the rash in measles and in the ear for ear-ache. It is held in the mouth to ease the pains of gum abcesses and to hasten their burning, and is taken in fever and in blood-poisoning. For further details refer to Watt and Breyer-Brandwijk (1962). During the course of this study it was noted that A. afra is also considered a cure for malaria.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Chabra (Pers. Comm.) observed that santonin, thujone, umbelliferone and some polyacetylinic compounds have been isolated from A. afra. These compounds are derived from the leaves and stem of the plant.

7. HARVESTING, CONSERVING AND PREPARATION

A. afra leaves and stems are collected and boiled to form a decoction. Alternatively, an infusion of leaves and stem is prepared; occasionally it is made up into a syrup by the addition of sugar.

A. afra leaves and stems after collection are air dried and then tied into bundles and stored in a dry place.

8. ECONOMICS AND MARKETING

There have been no studies carried out on the economics of A. afra as a traditional medicine. However, local herbalists collect the herb, prepare it for different remedies and sell it to local people. Due to its many uses A. afra has a great potential in the future especially when the active ingredients can be isolated, tested and administered in large quantities. At this point it would be necessary to raise it on a large scale and thus boost the income of growers.

9. SILVICS

The species regenerates from seed only. On ripening the seed falls on the ground where it germinates during the rainy season. It prefers soft or cultivated soils. The species does not tolerate shade and thrives with adequate tending. It is often grown locally on a small scale near houses in Tanzania.

10. MAJOR DISEASES

None specified.

11. OTHER USES

It is grown as an ornamental, and the leaves are mixed with cosmestic oil as a perfume.

12. BIBLIOGRAPHY

Agnew, A.D.Q. (1974) Upland Kenya wild flowers. A flora of the Ferns and Herbaceous Flowering plants of Upland Kenya. Oxford University Press. London. 827 p.

Brenan, J.P.M. and Greenway, P.J. (1949) Check-Lists of the Forest Trees and Shrubs of the British Empire. No. 5. Tanganyika Territory. Imp. For. Inst. Oxford. 653 p.

East Africa Meteorological Department (1975) Climatological Statistics For East Africa. Part III Tanzania. E.A. Met. Dept. E.A. Community. Nairobi. 92 p.

Harjula, H. (1980) Mirau and his Practice. A study of the Ethromedicinal Repertoire of a Tanzanian Herbalist. Tri-Med. Books. London. 223 p.

Kokwaro, J.O. (1976) Medicinal plants of East Africa, East African Literature Bureau, Nairobi.

Morgan, W.T.W. (1972) East Africa: its peoples and resources. Oxford University Press, Nairobi. 312 p.

Nshubemuki, L., Soni, F.G.R. and Clotu, C. (1978) A Forester's View on average monthly and annual rainfall and number of raindays over Tanzania. I Regional Comparison. Tanzania Silviculture Technical Note (New Series) No. 41. Mimeo.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa. E. & S. Livingstone Ltd. London. 1455p.

PLATE VII. Artemisia afra Jacq.

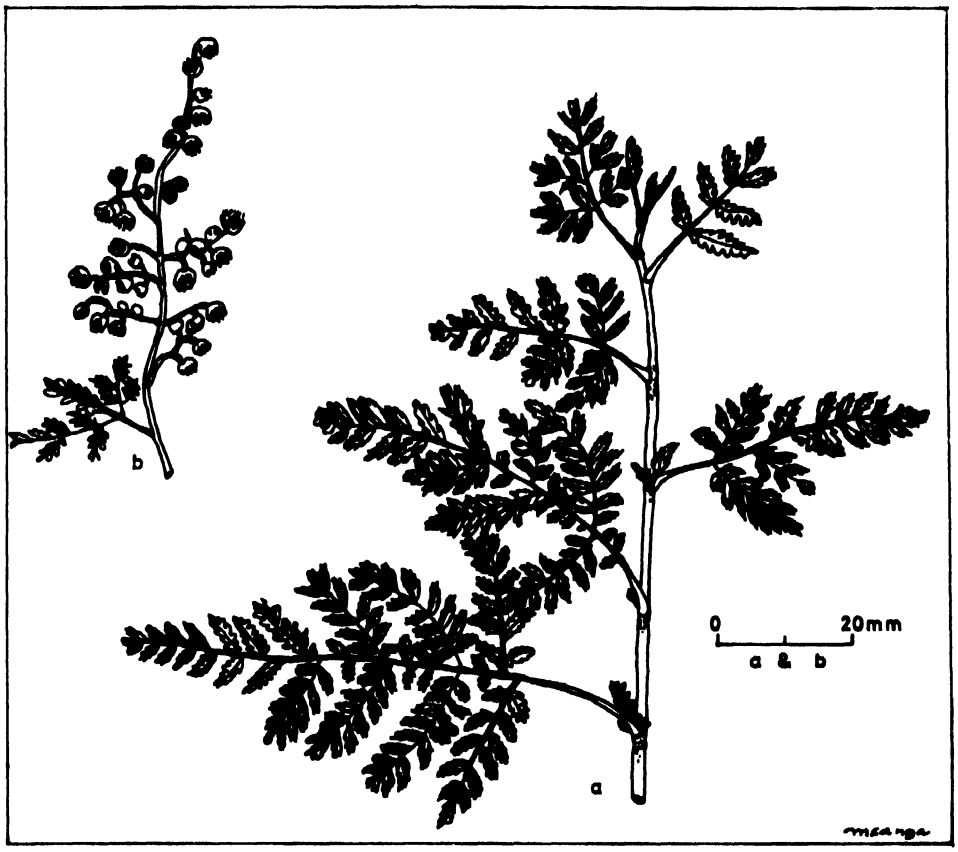


Plate VII. Artemisia afra Jacq.

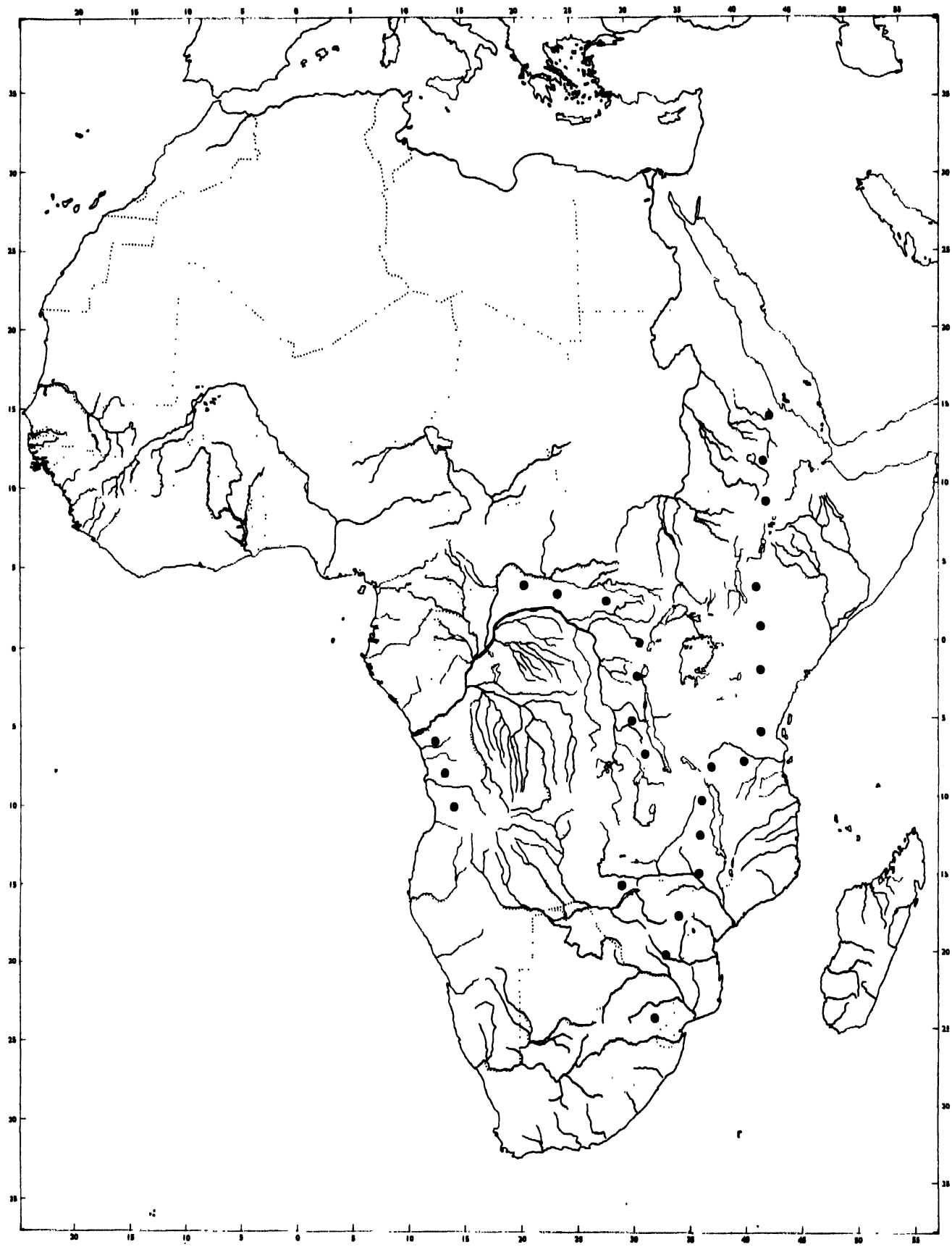
a. branchlet

b. inflorescence bearing flowerbuds and flowers

Plate VII-1.

Branchlet bearing flowerbuds and flowers.

MAP 7 - Geographic distribution of Artemisia afra



1. BOTANICAL NAME: Bridelia micrantha (Hochst.)Baill.

SYNONYMS: Candelabria micrantha Hochst.

FAMILY: Euphorbiaceae

COMMON NAMES: Apakyisie (Ashanti, Kwahu), Epakotrubo (Anyi), Mible (Ewe), Akati (Awuna), Wallinjang (Issala); Ida odan, Asha (Yoruba), Ogaofia (Ibo), Ogangan (Bini), Kensange (Boki); Umugimbo, Umushashi (Rwanda); Mwesa (Kihehe), Mwiza (Kisambaa, Kividunda, Kiswahili), Musmba mukalakore (Kiluguru), Mushamako (Kihaya), Mnamaji (Kifipa), Munyalamunzi (Kinyiha), Mmarie (Kichagga), Msamiko (Kizinga), Mkarangatanga (Kizaramo), Muira (Kipare). Musabayembe, Mushiminwanongo, Mutantsange (Bemba), Musabe (Kaonde), Mukunku (Kaonde, Lunde), Mumbuza (Lunda), Mlebezi, Mnazi, Msongamino (Nyanja), Munyansa, Munyanya, Mushiwe (Tonga) Mukoigo, Mureru (Kikuyu), Ngoronet, Chemaguldet (Nandi), Mukuegwe(Meru), Mukanganya, Shikanganya (kakamega), Adumho (Luo), Omutarakaranga (Kisii).

2. ECOLOGY AND DISTRIBUTION

Bridelia micrantha occurs in savanna and secondary forest, riverine woodland and gallery forest on a variety of soils from sandy clay loams to clay loams at altitudes ranging from 300m to 1700m. The mean annual rainfall is in the region of 800-2500mm.

The species is widely distributed in tropical Africa, occurring in Senegal, Gambia, Mali, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Nigeria, Cameroun, Zaire, Rwanda, Burundi, Sudan, Ethiopia, Uganda, Kenya, Tanzania, Mozambique, Malawi, Zambia, Zimbabwe, Angola and South Africa; intoroduced into Réunion (see distribution map).

3. DESCRIPTION

A much branched evergreen shrub or small tree up to 15(-20)m high; trunk sometimes crooked, bark rough, grey-brown to black; slash thin, fibrous, brown to dark red; branches often spiny. Leaves alternate, simple, stipulate; stipules lanceolate-acuminate, 5-7mm long; blade elliptic, oblong-elliptic or obovate, 4.5-18cm long, 1.5-7cm wide, apex subobtuse to acuminate, base generally rounded, margins entire or slightly wavy, subcoriaceous, deep glossy green above, paler and minutely appressed-puberulous below (hairs sometimes only visible with a lens); lateral nerves 8-14 pairs, scarcely prominent and reaching the margins without branching; petiole 3-10mm long. Inflorescence with flowers in axillary clusters containing male and female flowers. Male flowers on pedicels 1-2mm long, sepals yellow-green, triangular, 1.5-2mm long, petals obovate, shorter than the sepals, stamens 5; female flowers subsessile, disk enveloping the ovary, styles 2, forked. Fruit black, subglobose to ellipsoid drupe about 1cm long, 0.5-0.7cm in diameter, seeds 1.

In Tanzania flowering occurs during the rainy season, i.e. October to March with the fruit ripening towards the end of the rainy season extending into the dry season , i.e. from April to July.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

On the basis of literature reviewed, it is not known whether there are any pharmacologically active principles in the plant. It has been reported that the plant contains saponins (Haerdi 1964 In: Harjula, 1980).

5. FOLK MEDICINAL USES

The bark is boiled for 30 minutes and the decoction drunk as a remedy for stomach-ache and for tapeworm; or the bark may be boiled in soup and the soup given to small children with diarrhoea. For the latter treatment it is recommended that the children should eat nothing else when the remedy is taken, particularly in cases where the diarrhoea is accompanied by bleeding.

Pounded or powdered root is mixed with ghee and rubbed into the scalp to cure headaches. A decoction of roots is drunk to cure aching joints in the body.

The bark can be boiled to make a form of soup which is mixed with milk and given to children as a tonic. Pounded bark is mixed with water and the decoction given to cattle to treat snoring (Kokwaro, 1976).

The leaf sap of B. micrantha is used by Hava as an application to sore eyes and in West Africa the plant is used with a number others in a decoction for the treatment of conjunctivitis.

The Shambaa use the root as a remedy for severe epigastric pain and apply it to scalp for the relief of headaches. In both East and West Africa the root is used as a purgative (Watt and Breyer - Brandwijk, 1962). A decoction of root is drunk as a purgative, anthelmintic and antidote for poison. In the latter case the decoction causes vomiting or diarrhoea to get rid of the poison.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The plant is said to contain saponin (Haerdi, 1964 In: Harjula 1980).

7. HARVESTING, CONSERVING AND PREPARATION

The tree is debarked and the bark is dried and ground and the powder used to prepare an infusion. Roots are excavated, washed and a decoction prepared. The tree bark and roots are dried and tied in small bundles and stored.

8. ECONOMICS AND MARKETING

There has been no investigation into the economics of the medicinal values of B. micrantha. However, the roots, bark, leaves and wood are sold by local herbalists for the preparation of traditional medicines. There is great potential for deriving more income from B. micrantha provided that its medicinal values are analysed and publicised.

9. SILVICS

B. micrantha regenerates naturally from seed, coppice and root suckers. The seed is spread by birds which feed on it and distribute it out in the form of faeces. The seed germinates readily after decomposition of the pulp. Coppice shoots are produced after the trees are felled. Root suckers are produced if the roots are wounded e.g. by trampling animals, during cultivation etc. In general natural regeneration is adequate. However, it should be noted with concern that most of the seedlings and saplings succumb to competition with other weed plants. Thus crop refining could help in promoting natural regeneration.

10. MAJOR DISEASES

None specified. This is a common savanna and secondary forest shrub.

11. OTHER USES

The fruits are edible.

The timber is durable, fairly hard and is used for poles, bows, boats, carpentry, and most general joinery work. The wood makes excellent firewood and charcoal.

The resin is used for ceiling baskets and winnowing trays.

A red dye is extracted by boiling the bark and a black dye is obtained from the leaves, twigs and wood.

12. BIBLIOGRAPHY

Anon (1976) Atlas of the United Republic of Tanzania. Surveys Division. Min. of Lands.

Haerdi, F. (1964) Afrikanische Heilpflanzen, Acto-Propico: Suppl. 8 In: Harjula, H. (1980). Mirau and his Practice. A study of the Ethnomedicinal Repertoire of a Tanzanian Herbalist. Tri-Med Books. London: 312 p.

Hangile Kokwaro, J.O. (1976) Medicinal Plants of East Africa. E.A. Literature Bureau. Nairobi.

Morgan, W.T.W. (1972) East Africa: its peoples and resources. Oxford University Press. Nairobi. 312.p.

Nshubemuki, L., Somi, F.G.R. and Olotu, C. (1978) A Forester's View on average monthly rainfall and number of raindays over Tanzania. I Regional Comparison. Tanzania Silviculture Technical Note (New Series) No. 41. Mimeo.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa. E & S. Livingstone Ltd. London. 1455.

Dale, I.R. and Greenway, P.J. (1961) "Kenya Trees and shrubs" Government of Kenya and Hatchards, 187 Piccadilly London W.I.

PLATE VIII. Bridelia micrantha (Hochst.) Baill.

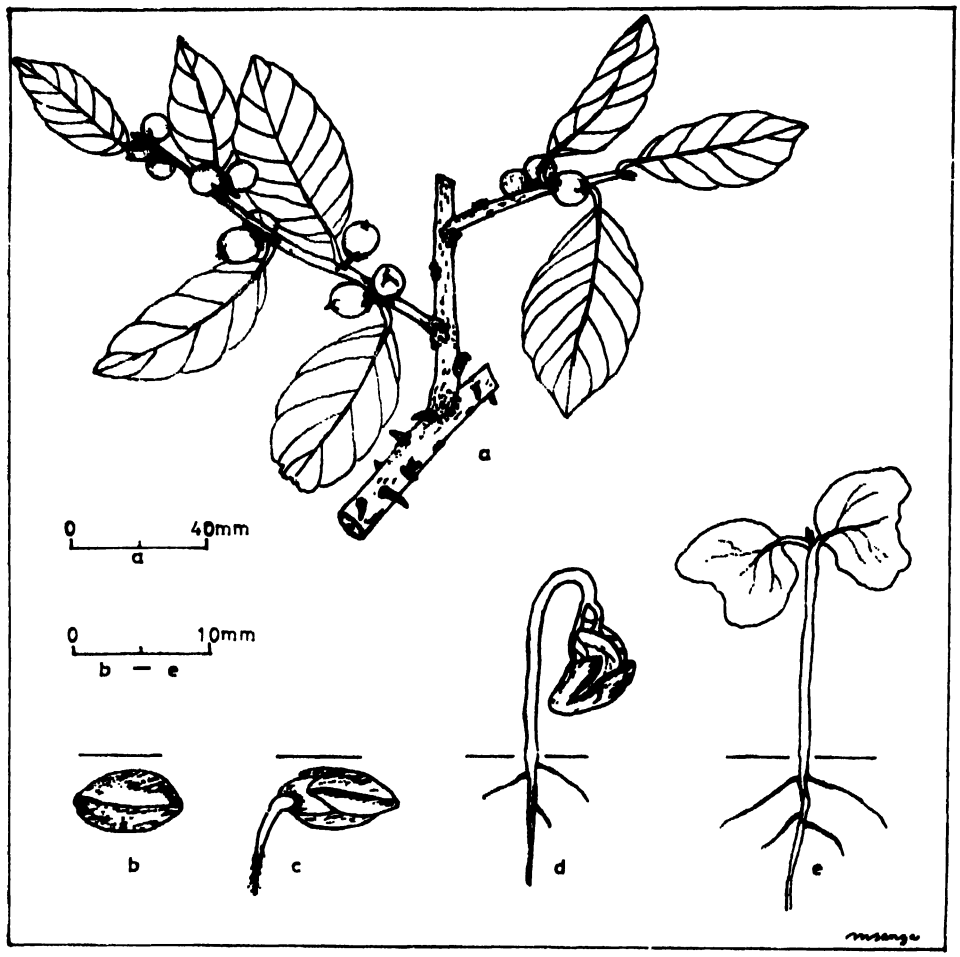


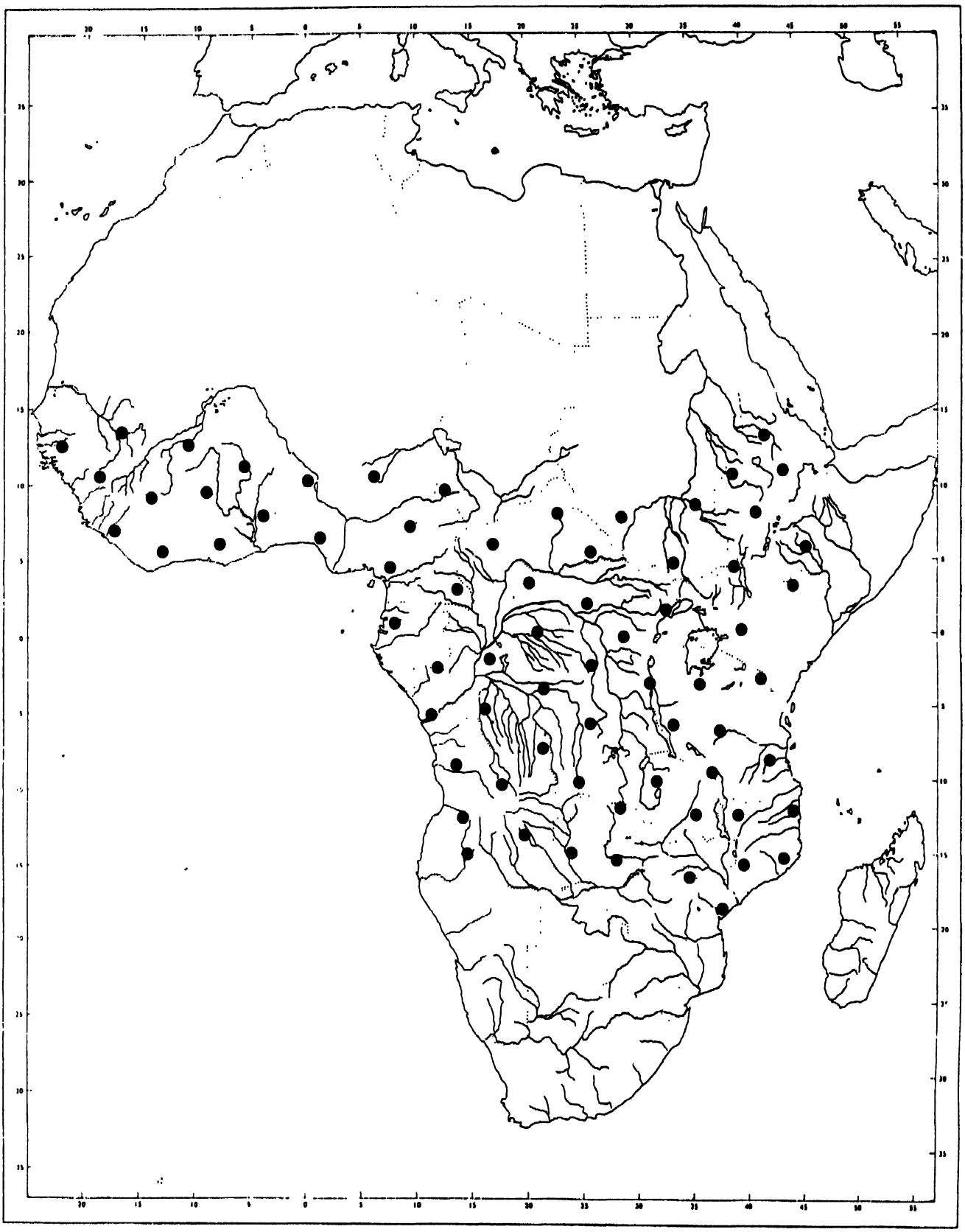
Plate VIII. Bridelia micrantha (Hochst.) Baill.

(a) flowering branchlet bearing mature fruits
(b)(c) stages in the germination of B. micrantha seed
(c) germination 14 days after sowing
(d) 21 days (e) 28 days after sowing

Plate VIII-1 tree at Utondolo, Lushoto, May, 1983 (Photo Ruffo)

Plate VIII-2 branchlet bearing mature fruits (Photo Ruffo)

MAP 8 - Geographic distribution of Bridelia micrantha



BOTANICAL NAME: Calotropis procera (Ait.)Ait.f.

SYNONYM: Asclepias procera Ait.

FAMILY: Asclepiadaceae

COMMON NAMES: Mpompompogolo (Bambara), Banabi (Peul), Toursa (Sonrai); Tumfafia (Hausa); Faftan (Wolof); Gbekebiiawuo (Ga), Blofo tootoo, Owula kofi ba (Abokobi), Agbo-loba (Ewe); Ushar (Arabic), Bo'ah (Boran & Somali), Etetheru (Turkana), Mufuthu (Kamba), Dead Sea Fruit.

2. ECOLOGY AND DISTRIBUTION

The natural distribution and habitat of Calotropis procera is somewhat obscured by its preference for areas of abandoned cultivation, especially sandy soils in areas of low rainfall. It is often dominant in such areas and assumed to be an indicator of over-cultivation.

It occurs in Mauritania, Mali, Senegal, Gambia, Sierra Leone, Guinea Bissau, Ivory Coast, Burkina Faso, Ghana, Niger, Nigeria, Cameroon, Fernando Po, Zaire, Chad, Sudan, Ethiopia, Somalia, Uganda, Kenya, Tanzania, Mali, Mozambique, Zambia, Zimbabwe, Morocco, Algeria, Libya, Egypt, Sinai, Israel, Syria, Lebanon, Iran, Iraq, Afghanistan, Pakistan, India, Kuwait, Saudi Arabia, S. Yemen, Oman, United Arab Emirates. Introduced into Australia, West Indies and Central America, probably introduced and naturalized in East Africa and parts of the Middle East (see distribution map).

3. DESCRIPTION

Shrub or small tree up to 2.5(-6)m high, stem usually simple, rarely branched, woody at the base and covered with a fissured, corky bark; slash yields a copious white latex; branches somewhat succulent, densely white tomentose, early glabrescent. Leaves opposite, simple, subsessile, stipules absent; blade oblong-obovate to broadly obovate, 5-30cm long, 2.5-15.5cm or more wide, apex abruptly and shortly acuminate to apiculate, base cordate, margins entire, succulent, white tomentose when young, later glabrescent and glaucous. Inflorescence a dense, several-flowered, umbellate cyme arising from the nodes and appearing axillary or terminal; flowers hermaphrodite, 5-merous; pedicels 1-3cm long. Calyx 5-lobed, shortly united at the base, lobes ovate, 4-7mm long, 3-4mm wide, glabrescent; corolla pale whitish-green with large purple patches on the lobes, campanulate, about 2cm in diameter, united at the base for 6-7mm, lobes narrow ovate, 11-20mm long, 9-10mm wide; corona of 5 compressed lobes 6.5-11mm long, 3-4.5mm wide, anthers opposite the corona lobes. Fruit a simple, fleshy, inflated, subglobose to obliquely ovoid follicle up to 10cm or more in diameter; seeds numerous, flat, obovate, 6mm long, 5mm wide, with silky white pappus 3cm or more long.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Compounds derived from the plant have been found to have emeto-cathartic and digitalic properties. Other compounds have been found to have bactericidal and vermicidal properties.

5. FOLK MEDICINAL USES

An infusion of bark powder is used in the treatment of leprosy. Two to four soup-spoons of bark powder are left to soak in 250 ml of water for 12 hours. The infusion is then filtered and drunk before breakfast. The milky sap is used as a rubefacient and is also strongly purgative and caustic. The root bark is an emetic and the flower a digestive, stomachic and tonic used for asthma and catarrh.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The latex contains heterosides, among them calotropin. It also contains a proteolytic enzyme called calotropaine as well as Calactin, Calotoxin, Uscharidin, Uscharin and Vouscharin, (Watt and Breyer-Brandwijk, 1962).

7. HARVESTING, CONSERVING AND PREPARATION

The bark can be dried in the sun without difficulty. It is inadvisable to use bark which has been kept for more than a year.

8. ECONOMICS AND MARKETING

Locally collected and used for domestic purposes.

9. SILVICS

Seeds freely; natural regeneration common.

10. MAJOR DISEASES

None specified.

11. OTHER USES

The bark and latex is widely used as an arrow and spear poison; also used to curdle milk and in brewing. The floss from the seeds is used as an inferior kapok for stuffing pillows (Madar floss or akund) as well as for weaving into a strong cloth. The stems are termite-proof and used for building huts.

The stems also produce a good charcoal; the stem pith can be used as tinder. The bark can be used for tanning and the flowers and withered (not fresh) leaves can be browsed by sheep and goats, (Irvine, 1961).

12. BIBLIOGRAPHY

Irvine, F.R. (1961) Woody plants of Ghana with Special Reference to Their Uses. London. Oxford University Press. pp. 233-236.

Watt, J.M. and Breyer-Brandwijk, M.F. (1962) The Medicinal Plants of Southern and Eastern Africa, being an account of their medicinal and other uses, chemical composition, pharmacological effects and toxicology man and animals. Edinburgh and London. E. and S. Livingstone Ltd.

Dale, I.R. and Greenway, P.J. (1961) "Kenya Trees and shrubs" Government of Kenya and Harchards, 187 Piccadilly London W.I.

PLATE IX. Calotropis procera (Ait.) Ait. f.

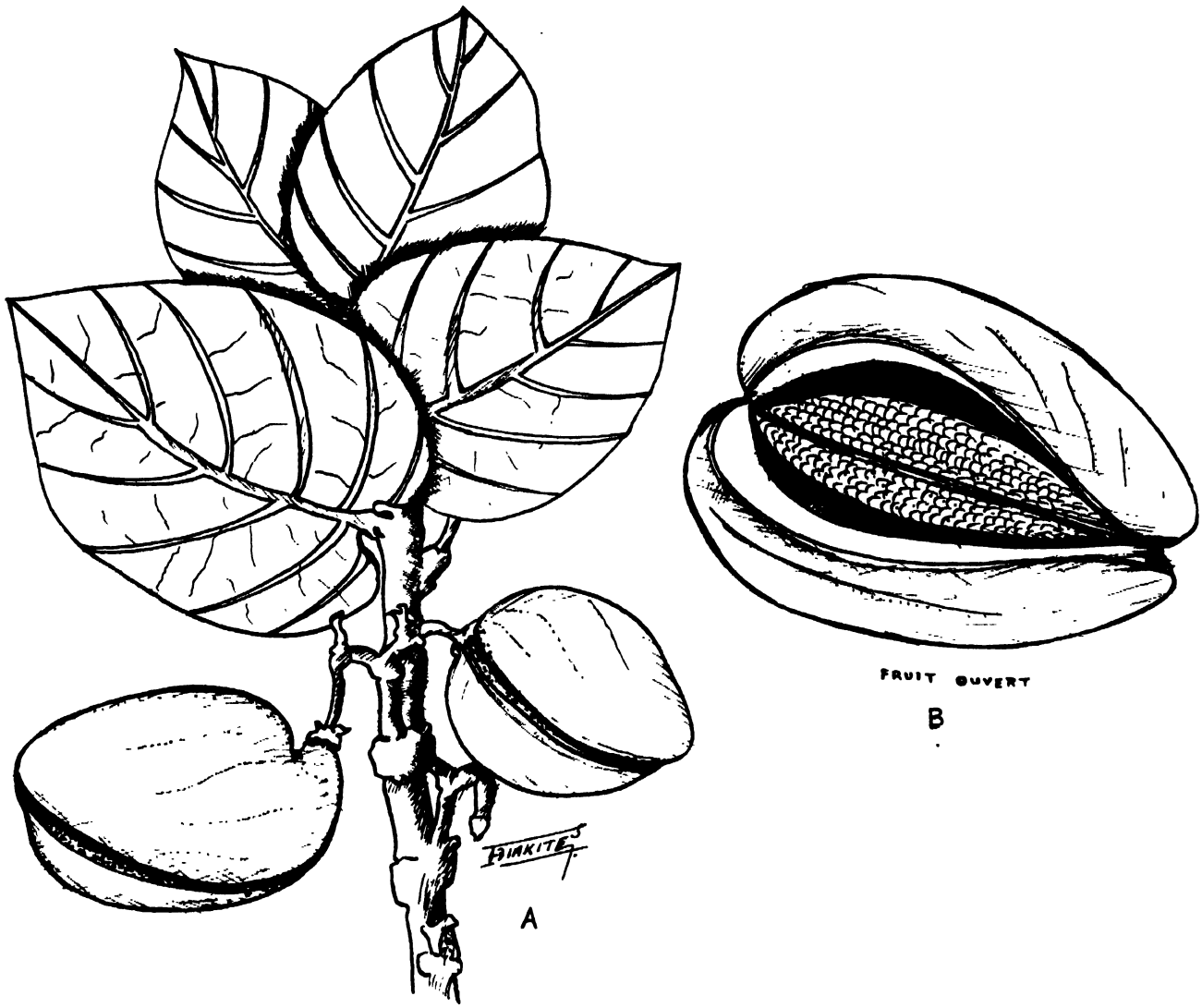


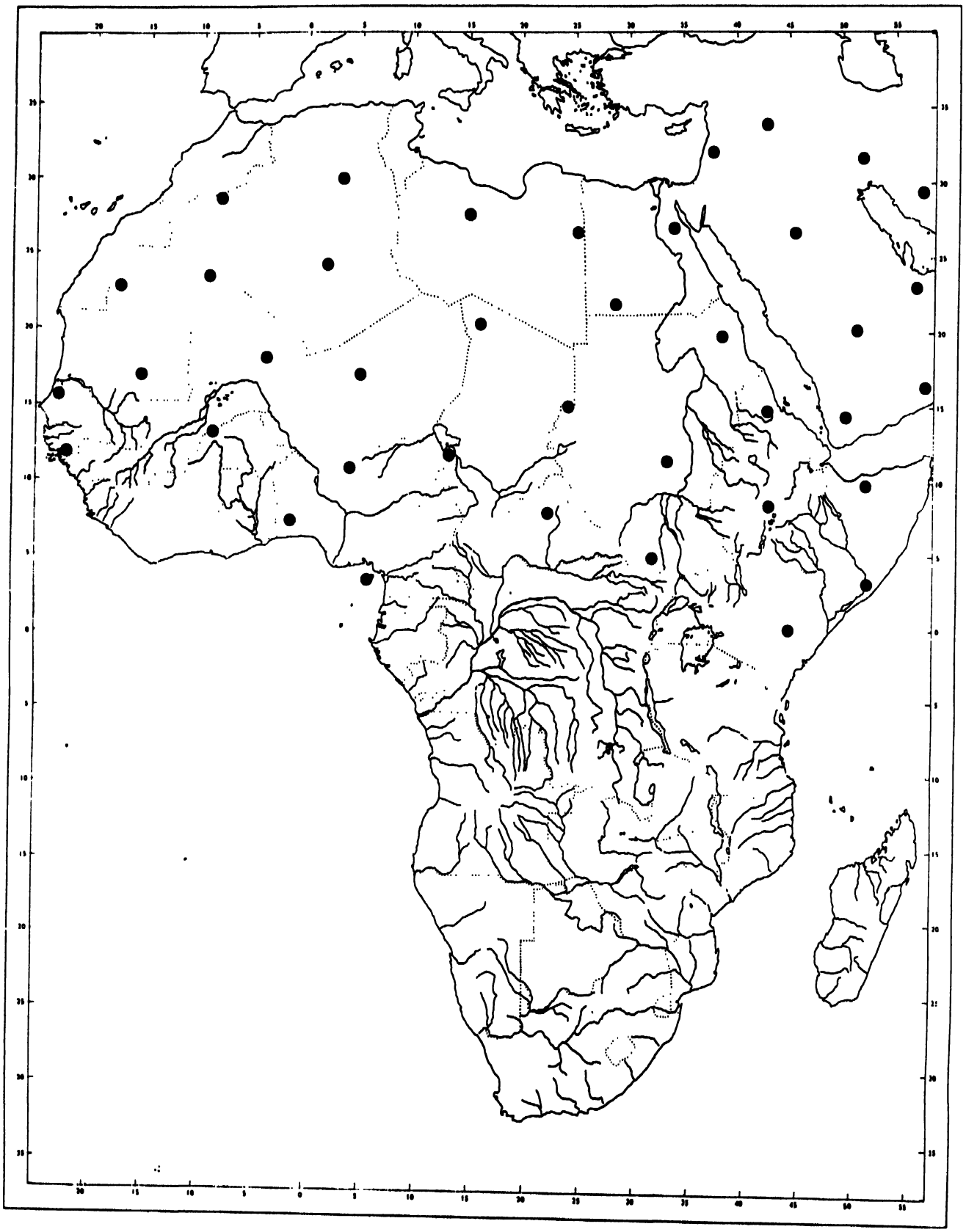
Plate lX. Calotropis procera (Ait.) Ait. f.

A. branch bearing fruit B. open fruit

Plate IX-1

Calotropis procera plant bearing fruit

MAP 9 - Geographic distribution of Calotropis procera



1. BOTANICAL NAME: Casimiroa edulis Llave and Lex.

SYNONYMS: Zanthoxylum bombacifolium A. Rich.
Zanthoxylum araliaceum Turcz.
Fagara bombacifolia (A. Rich.) Krug and Urb.

FAMILY: Rutaceae

COMMON NAMES: Zapote blanco, Chapote, Matasano (Spanish); Cacchique (Maya); Ceaxmisttea (Otomi); Cochitzapoti (Nahuatl).

2. ECOLOGY AND DISTRIBUTION

Casimiroa edulis occurs in subtropical deciduous woodlands and low forests at altitudes between 1200 and 2400m.

The species is widely distributed in Mexico; cultivated in California and West Indies (see distribution map).

3. DESCRIPTION

An evergreen tree, 1-12m high, branches spreading, crown broad, leafy. Leaves alternate, digitate; stipules absent; petiole 5-9.5cm long, finely pubescent; leaflets sessile or subsessile, 3-5(-7), elliptic, ovate or broadly ovate, 4.5-12cm long, 1-5cm wide, apex acuminate, retuse or occasionally rounded, base cuneate, margins subserrate, bright green, glabrous or with scattered pubescence on the veins, venation pinnate, anastomising at the margins. Inflorescence paniculate; flowers small, regular, unisexual, 5-merous. Sepals lacinate, hirsute; petals greenish-yellow, 3-7mm long; stamens 5, filaments subulate, thickening at the base; ovary superior, 5-celled, stigma sessile, lobate. Fruit an edible, yellowish-green, spherical or ovoid drupe, 6-10cm in diameter, smooth, pulp sweet; seeds usually 5, 18-23mm long.

Fruiting June-July (-August).

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None identified.

5. FOLK MEDICINAL USES

In addition to its value as a food, the fruit is considered medicinal, the seed being used to prepare infusions to which the people have for centuries attributed sedative effects. The leaves of the tree are also used for the same purpose, with the advantage that they can be found throughout the year, while the fruit is available only in June and July, when it ripens and appears on the markets of the Mexican altiplano.

The medicinal use of Casimiroa edulis goes back to very ancient, pre-Hispanic-times, but apart from the suggestive name given to it by the Nahoas (cochitzapotl means 'sweet fruit that produces sleep'), we do not know what role this plant played in indigenous medicine. The Spaniards reported the "hypnotic" properties of the seeds and leaves of the sapodilla in their medical chronicles and herbals throughout the colonial period. For a long time it was considered "narcotic", but during the last century Mexican scientists failed in their attempts to prove this, observing only an apparent sedative effect in patients who drank a tisane of Casimiroa leaves or an alcoholic extract prepared with its seeds.

More careful observations made in Mexican hospitals at the end of the 19th century showed that Casimiroa edulis produced a sustained lowering of arterial pressure, while at the same time it was established that the cerebral functions of animals and patients to experimentation did not alter significantly.

In the first decades of the present century, more knowledge was acquired of the hypotensive effect of the infusion and alcoholic extract of Casimiroa edulis. This information spread among the people and traditional Mexican medicine assimilated it rapidly. Present ethnobotanical and medical anthropology studies show that the Mexican people use the leaves and seeds of Casimiroa very frequently in the treatment of hypertension, with astonishing results. The hypertensive patients drink an infusion of leaves and/or seeds, two hours before their accustomed bedtime. They then experience a state of slight sedation, with marked and sustained hypotension, the effect of which lasts for several hours. The hypertensive patients control their blood pressure, by using this tisane regularly, substituting it for coffee and any other infusion. The seeds are stored dry, for years, and can be found easily in the herbalist markets. The leaves are stored in bundles for the preparation of infusions throughout the year.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

There has been considerable scientific investigation of Casimiroa edulis during the last 30 years. The bark, seeds and leaves have proved to contain many components, of which the following are particularly important because of their pharmacological interest: casimiroine, zapotine, n-benzoiltiramine, zapotidine, zapoterine, casimirolide (obacuanonoa), eduline, zapotidine and casimirodine. The biodynamic properties of these compounds are little known, since pharmacological attention has been concentrated on other compounds of Casimiroa, such as n-methylihistamine and n-dimethyl histamine. Histidine and histamine themselves have also been detected in this plant. Chemical studies much preceded pharmacological ones, owing to the interest that various foreign pharmaceutical firms have been taking in this plant for several decades. The main purpose of these studies was to look for products with narcotic properties, which were never demonstrated; and for a long time it was thought that the hypotensive action of Casimiroa extracts was irrevelant because this effect was due to the presence of histaminic products. However, recent studies have shown that, contrary to what might be theoretically expected, the hypotensive effects of such histaminic products have a wide and important medicinal application because the action is very similar to that described for some antihistamines, in which a persistent peripheral vasodilatation has been observed which explains the hypotension accompanied by a slight sedative effect on the central nervous system. Use of the complete extract of seeds or leaves of C. edulis has no undesirable secondary effects.

7. HARVESTING, CONSERVING AND PREPARATION

Leaves, bark and seeds locally collected and used.

8. ECONOMICS AND MARKETING

The synergy of chemical products derived from the plant on the cardio-vascular function is still under study, but the economic and medicinal importance of this resource are already evident.

9. SILVICS

Can be grown from seed, commonly cultivated in Central America and to some extent in Florida and Southern California (Morton, 1977).

10. MAJOR DISEASES

None specified.

11. OTHER USES

The pulp of ripe fruits is eaten as a dessert in Mexico and El Salvador, but is considered by many to be "soporific and unwholesome" (Morton, 1977).

12. BIBLIOGRAPHY

De Lille, J. (1937) — Anal. Inst. Biol. 5: 45-47.

Djerassi, C. (1958) — Tetrahedron Letters. 2:168.

Lozoya, X. et al. (1977 and 1978) — Arch. Invest. Méd. (Méx.). 8: 145 and 9: 565.

Lozoya, X. and Enríquez, R. (1981) — El zapote blanco. Investigación sobre una planta medicinal mexicana. Ed. CONACYT, México.

Martínez, M. (1951) — Anal. Inst. Biol. 11(1): 26-56.

Major, R. and Duch, F. (1958) — J. Org. Chem. 23: 1564.

Meisels, A. and Sondheimer, F. (1957) — J. Am. Chem. Soc. 79: 6328.

Morton, J.F. (1981) — Atlas of Medicinal Plants of Middle America, Bahamas to Yucatan C.C. Thomas, Publisher, Springfield, ILL. U.S.A.

Panzica, P. (1973) — J. Am. Chem. Soc. 95: 8738.

Power, F. and Callan, T. (1911) — J. Chem. Soc. 99: 1993-2010.

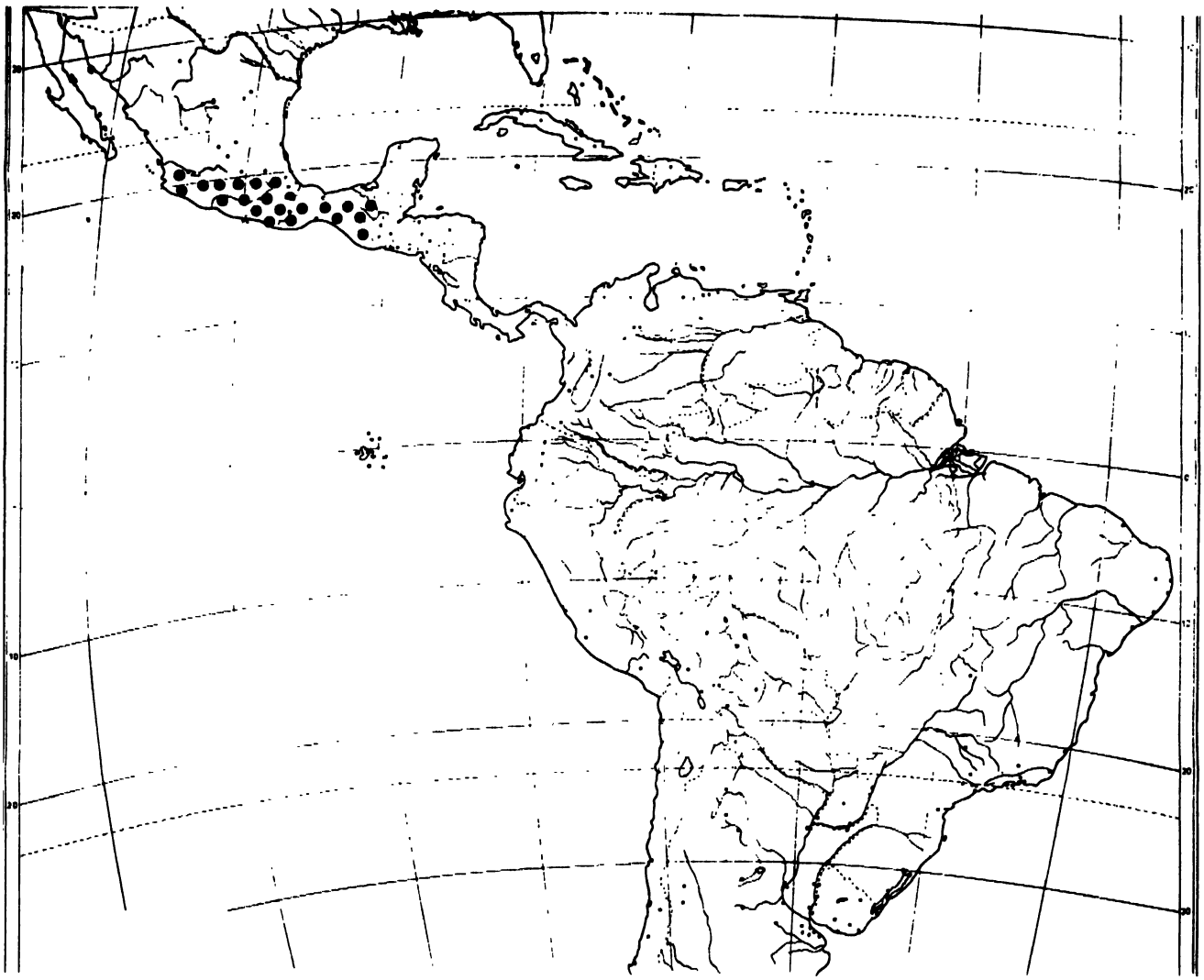
Sondheimer, F. and Meisels, A. (1958 and 1959) — J. Org. Chem. 23: 762 and 24: 870.

PLATE X. Casimiroa edulis Llave et Lex.

Plate X. Casimiroa edulis Llave et Lex.

Fruits and leaves of Casimiroa edulis, Zapote Blanco (After M. Martinéz, 1961, Las Caşimiroas de Mexico. Anales Inst. Biologica, Mexico)

MAP 10 - Geographic distribution of Casimiroa edulis



1. BOTANICAL NAME: Chlorophora excelsa (Welw.) Benth. & Hook.

SYNONYMS: Maclura excelsa (Welw.) Bur.
Chlorophora tenuifolia Engl.
Chlorophora alba Chev.

FAMILY: Moraceae

COMMON NAMES: Iroko (trade name), Semo (Kissi), Odum (Ghana), Loko (Hausa), Roko (Yoruba), Iroko (Bini), Osan (Boki), Kambala (Zaire), Dago (Anuak), Mvule (trade name in W. Africa, Swahili) Mururi (Meru), Minarui (Boni) Muri (Taveta, Mutumbav, Murumba (Kavirondo) Olua (Luo), Ka Tema (Sierra Leone), Semli (Liberia), Sime (Guidea), Odum (Ivory Cost), Abang (Cameroon, Gabon) Mandji (Gabon), Molundu, Lusanga (Congo), Mereira (Angola), Mufule, Intule, Mandji (Mozambique).

2. ECOLOGY AND DISTRIBUTION

Chlorophora excelsa is found in deciduous, semi-deciduous or evergreen forests, often gallery forests and sometimes in isolated relic forests from sea level to about 1300m. It is never frequent but may be found in fairly large numbers in the drier parts of the semi-deciduous forests of the Antiaris-Chlorophora Association. In West Africa it occurs where the annual rainfall is between 1150mm and 1900mm and the temperatures between 25°C and 35°C. It is known to survive in drier areas where soil moisture conditions are favourable. Chlorophora prefers well-drained soils and is intolerant of impeded drainage. It is highly light demanding even though the young stem does better under shade where it obtains protection from the gall attack of Phytolema lata (Scott).

Chlorophora is a common tree around villages and in old farms as it is usually left by farmers because of its commercial value. It regenerates naturally in open places, along roads and newly cleared farms. Under favourable conditions an initial annual growth of 0.6-1m is not unusual. The succulent young shoots are often browsed by duiker and other animals.

Ripe fruits are edible and attract birds and bats who at the same time assist in seed dispersal.

Chlorophora excelsa is widespread in tropical Africa. It occurs in Sierra Leone, Ivory Coast, Ghana, Togo, Dahomey, Nigeria, Cameroun, Fernando Po, Gabon, Sudan, Ethiopia, Uganda, Kenya, Tanzania, Zaire, Mozambique, Malawi, Zimbabwe and Angola, (see distribution map).

3. DESCRIPTION

A large, sometimes deciduous, dioecious (rarely monoecious) tree to 60m high and 2.5m or more in diameter; butresses usually short, blunt, sometimes with rootspurs and large exposed reddish brown lateral roots with horizontal yellowish lenticels; bole straight, cylindrical with about 30m clear of branches, bark grey to dark brown or blackish, smooth at first, later rough and flaking, seldom fissured, slash cream with brown spots exuding a copious white latex; branches ascending, tending to form a flat crown, foliage dark green and dense. Leaves alternate, simple, petiolate; petiole 2.5-6cm long; stipules 0.5-5cm long; blade broadly elliptic, 10-25cm long, 5-15cm wide, apex rounded with a very short acuminate tip, base unequally cordate or sometimes rounded, margins entire, thick glabrous above and below except for minute hairs between the network of veins; lateral veins 10-22 pairs, up-curving near margin, prominent and looped below. Leaves of seedlings and saplings oblong-elliptic, with serrate margins and densely hirsute below.

Leaves of seedlings and saplings oblong-elliptic, with serrate margins and densely hirsute below. Inflorescence axillary; male catkins pendulous, 20-32cm long, 6-8mm in diamter, flowers white, densely crowded; female catkins 2-4cm long, 14-18mm in diameter, flowers greenish, styles protruding. Fruits a syncarp, subcylindrical, 4-7.5cm long, 2-2.5cm in diameter, wrinkled and fleshy (resembling a fat green caterpillar); achenes 2mm long.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

A substance with fungicidal properties has recently been isolated from the wood (Kerharo and Bouquet 1950).

The resinous latex is applied to craw-craw. It is considered slightly caustic and when applied on cotton wool to carious teeth is said to cause them to fall (Pobeguin 1912). The latex applied to wounds and burns is antiseptic and healing (Kerharo and Bouquet 1950).

5. FOLK MEDICINAL USES

The latex is used in the Lower Congo to reduce tumors and obstructions of the throat and on the Equator for stomach affections (Staner and Boutique 1937).

The latex and a bark infusion are considered to help lactation in Equatorial Africa, so do the leaves cut up and cooked with groundnuts (Walker 1953). A leaf decoction is used in Sierra Leone as a wash for fevers (Dalziel 1936). The bark is sometimes considered expectorant and it is used for cough in Ghana (Irvine 1961). It is also applied as an enema for the cure of piles, diarrhoea and dysentry. The pounded bark mixed with the kernel of Okoubaka aubrevillei fruits is taken internally in alcohol to cure piles (Traditional). The bark infusion is used in the Congo as a purgative. (Fl. Congo Belge 1.57).

The crushed bark in water or palm wine is drunk for heart troubles, lumbago and general fatigue. A bark decoction is used as a drink or sitz-bath for elephantiasis of the scrotum. It is used with Alchornea cordifolia, Annona senegalensis and Microglosa volubilis for leprosy. (Kerharo and Bouquet 1950).

The bark is an ingredient in a mixture used in a hipbath for venereal sores and as a wash for chancre Dalziel 1936). The ashes from the bark with palm oil are rubbed on swelling in Liberia.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The occurrence of stone in the wood of Chlorophora has long been known. Its composition is mainly "calcium carbonate". (Fischer and Campbell 1932). Two authors also describe the finding of another crystalline substance associated with this stone which they suggest is a hydrate of "calcium-malate". (Taylor 1960, p. 247).

From the wood a phenolic substance "chloropherine" $C_{18}H_{22}O_3$, has recently been isolated. This is a derivative or "resorcinal" and is said to have fungicidal properties (Kerharo and Bouquet 1950). The fine dust produced in machining is said to cause irritation of the skin occasionally.

7. HARVESTING, CONSERVING AND PREPARATION

Chlorophora is one of the most valuable timber species in Ghana. The tree is felled, cross-cut by chain saw into logs and extracted as timber. The wood is exported from Ghana only as sawn timber and this is effected by milling. Seasoning of the sawn materials is by air or kiln drying.

The bark and the leaves are easily obtainable at the felling sites. For medicinal uses the bark is sometimes pounded and dried and compressed into balls and kept in wrappers.

8. ECONOMICS AND MARKETING

The timber is of high commercial value and fetches high prices. It is classified among the class I species in Ghana and has both local and external markets.

9. SILVICS

Chlorophora excelsa is a strong light demander and cannot tolerate shade. It thrives on well drained soils and avoids swampy areas. Many of the fruits fall under parent trees but the seeds are mainly distributed by birds and bats. Natural regeneration is fairly good in open places but it is usually attacked by galls which retard its growth and sometimes kill it.

Fresh seeds germinate easily in about 16 days, with about 88% success, but the seeds have short viability. The fruits are best mashed and washed in water. The seeds are then dried and sown "broad-cast". Seedlings can be pricked and lined out about 3 weeks after germination. Height growth about 0.7-1m in 6 months and up to about 2m in one year has been recorded (Taylor 1960, p. 249). It establishes well both by striplings and stumps.

Chlorophora excelsa has been planted in some parts of Ghana in plantation and Taungya farms with little success due to the incidence of gall attack. Planting out by mixtures is preferable to pure crop.

10. MAJOR DISEASES

Seedlings and saplings are subject to gall attack (Phytolyma lata Scott). They burrow into the soft tissues of the buds, leaves and young shoots and galls are produced about 9 days after egg laying.

The galls cause a loss of leaves and buds and so growth is retarded. Other buds develop which in turn are liable to be infected. A very branched plant results, if it is not killed. Once the plant has reached a height of about 4m or more it is almost free from attack. Its recovery is certainly easy at this stage.

The incidence of attack is directly correlated with light. It is possible to grow the plants under sufficient shade to keep down the infestation. Seedlings under shade in the forest are fairly free from gall. (Taylor, 1960).

11. OTHER USES

The wood is yellowish brown with pale yellowish sapwood, but darkens after drying to dark brown. It is hard with average weight (about 657kg/m^3) at about 15% moisture content. It has interlocking grain with medium coarse texture. It is durable and fairly resistant to fire, termites and decay.

It seasons satisfactorily in both air and kilns with very little shrinkage and degrade. It works well with both hand and machine tools.

It is used for all kinds of construction and general carpentry. It is suitable for high classs joinery, furniture, interior fittings, wagon frames, doors, windows, staircases, mortars, bench-tops and decking of bridges. It is also suitable for piling and marine work. The sapwood makes good charcoal. The bark is said to be used in dying leather and cloth. Mature leaves abrasive and used as sandpaper.

The tree is regarded in certain parts of West Africa, particularly in Iboland (Nigeria), as a sacred plant and the bark is an ingredient used on ceremonial occasions.

12. BIBLIOGRAPHY

Atta Agyeman, E. (1980) Sixty Seven Selected Illnessses and their herbs as approved by the Ghana Psychic and Traditional Healing Association, Accra.

Dalziel, J.M. (1937) The useful plants of West Tropical Africa. London: Crown Agents.

Campbell, W.G. and Fischer (1932) The composition and origin of "Stone" in Iroko Wood. Empire Forestry Journal II 244-245.

Irvine, F.R. (1961) Woody Plants of Ghana. London: Oxford University Press.

Keay, R.W.J., Onochie, C.F.A. and Stanfield, D.P., (1960) Nigerian trees Vol.1. Lagos: Federal Govt. Printer.

Kerharo, J. and Bouquet, A. (1950) Plantes medicinales et toxiques de la Côte d'Ivoire - Haute Volta, Paris: Vigot edit.

Pobeguin, H. (1912) Les plantes medicinales de la Guinée, Paris.

Staner, P. and Boutique, R. (1937) Matériaux pour l'étude de plantes médicinales indigènes du Congo belge. Inst. Roy Colon. belge Sect. de Sci. Nat. et. méd. Mém.5 fasc. 6.

Taylor, C.J. (1960) Synecology and Silviculture in Ghana. Edinburgh. Nelson & Sons.

Dale, I.R. and Greenway, P.J. (1961) "Kenya Trees and shrubs" Government of Kenya and Hatchards, 187 Piccadilly London W.I.

PLATE XI. Chlorophora excelsa (Welw.) Benth. and Hook.

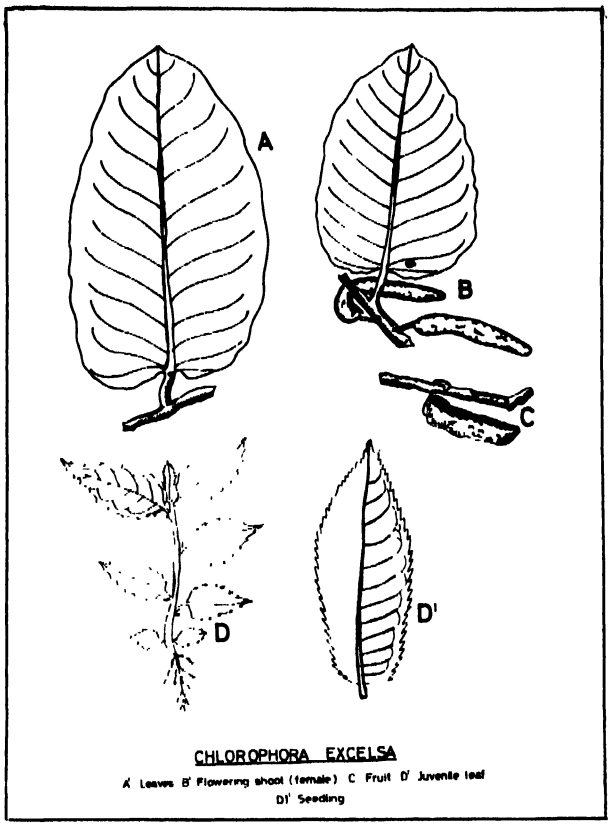


Plate XI. Chlorophora excelsa
(Welw.) Benth. and Hook.

A. leaves

B. flowering shoot, female

C. fruit

D. juvenile leaf

D1 seedling

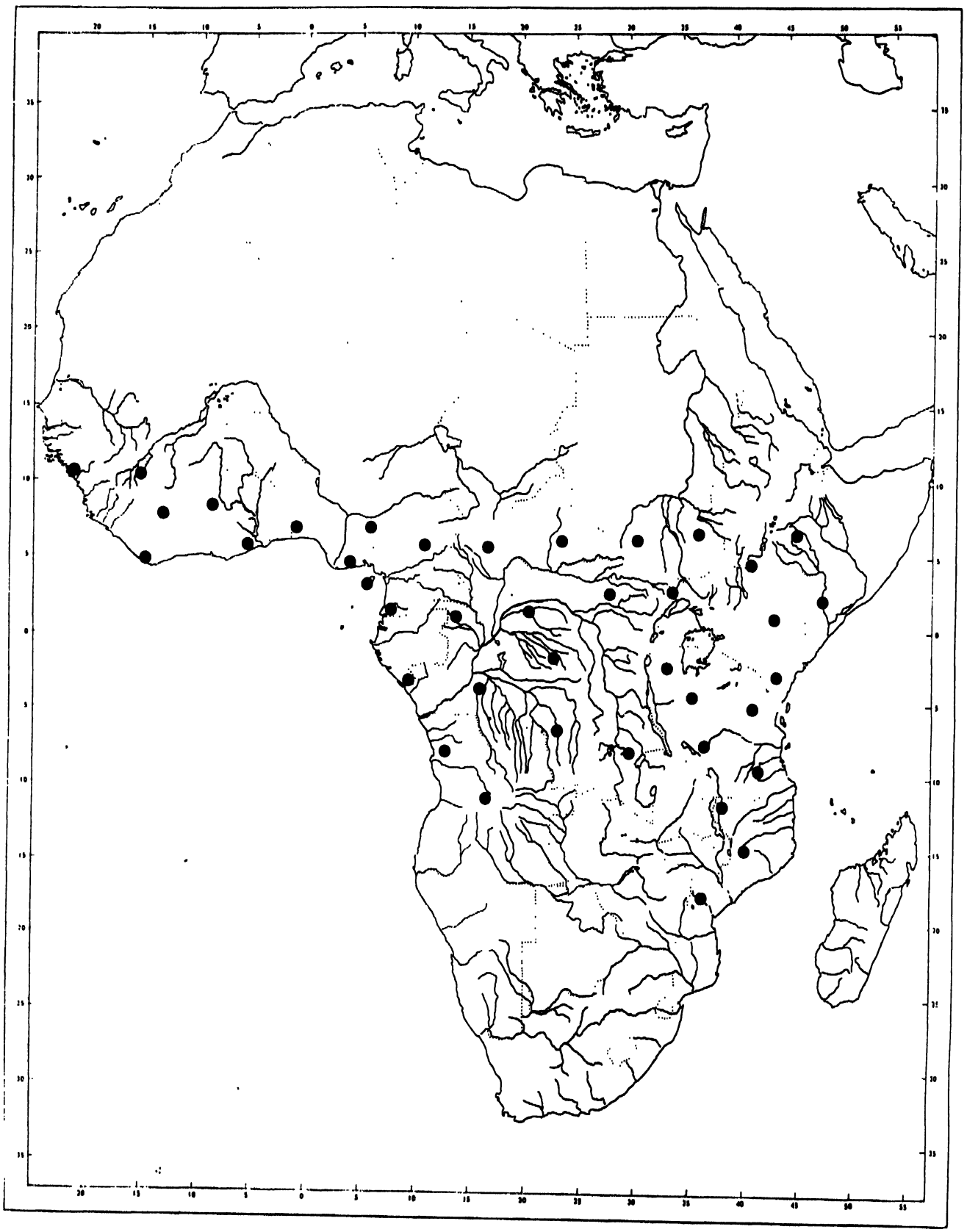
(B + C after Keay et al. 1960

D + D1 after Taylor, 1960)

Plate XI-1 branch of
Chlorophora excelsa

Plate XI-2 dried herbarium specimen
of leaves of C. excelsa

MAP 11 - Geographic distribution of Chlorophora excelsa



1. BOTANICAL NAME: Cola nitida (Vent.) Schott & Endl.

SYNONYMS: Cola vera K. Schum.
Cola acuminata (P. Beauv.) Schott & Endl. var. latifolia K. Schum.
Cola acuminata sensu Engl.

FAMILY: Sterculiaceae

COMMON NAMES: Commercial Cola-nut, Bitter-Cola; Bese, Bese-Pa (Twi, Ashanti, Wassaw) Bose (Fante), Esele (Nzima), Awase (Aowin, Sefwi), Goro (Hausa); Obi gbanja (Yoruba); oji (Ibo); chigban'bi (Nupe).

2. ECOLOGY AND DISTRIBUTION

Cola nitida is a native in the lowland forests of Sierra Leone, Liberia, Ivory Coast and Ghana. Its status in Senegal, Mali and Guinea has been confused by planting. It has been introduced to Togo, Nigeria, Fernando Po, Gabon, Zaire and Angola (see distribution map). It is generally not common in the natural forest. It is often cultivated in and around villages. Where it is found in the high forest, it is an indication of an earlier settlement. It is a shade bearer, but does better in the open. It prefers well drained soils although it may be found in marshy areas.

It generally thrives best where the annual rainfall is between 1300 and 1800mm and the temperature between 26° and 35°C. Though it is essentially a lowland tree it has been found at altitudes over 300m.

3. DESCRIPTION

Understorey, evergreen tree 9-12(-27)m high, up to 1.5m in diameter, narrow buttresses extending for 1m in old trees, or absent, bole not always straight and cylindrical; bark grey or greyish brown, rough with longitudinal fissures; slash pinkish red, thick and fibrous but darkens to brown on exposure. Leaves simple, alternate, petiolate; petiole 1.2-10cm long; blade broadly oblong to broadly elliptic or elliptic-oblanceolate, 10-33cm long, 5-13cm wide, apex abruptly and shortly acuminate, base obtuse or rounded, margins wavy, glabrous or nearly so; leathery, dark green, lateral nerves 6-10, the lowest arising close to the base and running parallel to the margin, obscure above, prominent to the base and running parallel to the margin, obscure above, prominent below. Inflorescence axillary, an irregularly branched panicles 5-10cm long, shorter than the leaves; flowers unisexual, 5-merous, apetalous. Male flowers with calyx cup-shaped, about 2cm in diameter, deeply lobed, stamens numerous, in two whorls. Female flowers with calyx about 5cm in diameter, with 5 carpels and numerous rudimentary anthers at the base. Fruits oblong-ellipsoid follicles 13cm long, 7cm in diameter, green, shiny surface, smooth to the touch but knobbly with large tubercles. Seeds 4-8(-10) per carpel, ovoid or subglobose 3-3.5cm long, 2-2.5cm in diameter, either red or white.

The flowering period is from May to July and fruiting October to December.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Cola nuts act as a stimulant to the nervous system when chewed and as a restorative.

They counteract overstrain and depression thus improving the physical and mental state. The principal action is that of caffeine, viz., stimulation of the nerves and direct muscular excitation. The tonic action on the heart is like that of caffeine exerted through the nervous system and by direct action on the heart-muscles and the walls of the blood vessels. The sense of fatigue is prevented and a longer and more sustained muscular effort is encouraged.

In combination with the coca-leaf a drug was made which was used as "Forced March" tablets for explorers, military expeditions etc. and also incorporated in brands of cocoa, tonic wines and other beverages (Dalziel, 1936).

The nuts taste bitter when chewed at first but they leave a sweet taste in the mouth later. Thus chewing cola nuts before drinking water helps to render the water more sweet.

Cola nuts chewed at night tend to prevent sleep.

Early accounts (16th Century) mention that the people of the Cape Verde region chewed cola nuts to enable them to go without food and to improve the quality of drinking water (Dalziel, 1936).

The nuts are said to be sustaining when chewed and to possess thirst-restraining properties (Taylor, 1960).

5. FOLK MEDICINAL USES

In Ghana, some traditional healers sometimes add extracts from cola nuts to certain drugs to make the drugs more effective. The crushed nuts are boiled together with the the leaves of Morinda lucida and the liquid taken internally to cure piles. The nuts ground to a fine paste together with the leaves of Scoparia dulce, are dissolved in a little water and a few drops are administered orally to babies for headache.

An infusion of the bark mixed with ginger and a little pepper is taken internally to cure stomach ulcers. The nuts, preferably the white variety, ground to a fine paste together with white clay, a little pepper, ginger or Piper guineense fruits are applied as an enema for the cure of diarrhoea and dysentry (Traditional Medicine).

In Lagos, cola nuts given along with European drugs enable patients to do without food and so rest the digestive organs (Dr. O. Shapara ex. Dalziel, 1936).

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Cola nut is generally supposed to contain about equal quantities of "caffeine" and "theobromine" but the latter occurs only in traces. Heckel and Schlagdenhauffen (1883) determined the existence of both "caffeine" and "theobromide" and a new body called "kola-red" which was supposed to account for the physiological action of the fresh nuts as compared with that of the free caffeine in the dried nuts. "Kola-red" was re-described by Knebel (1892) under the name "Kolatine".

According to Goris (1911), the essential composition of the sterilised Cola nut is as follows:-

(a) "Kolatine caffeine", this disintegrates easily so that the dry nut yields no caffeine.

(b) "Kolatine", a crystalline body of the catechin group, easily altered by light, warmth or an oxydising ferment (oxydase) into a red amorphous product.

(c) "Kolateine", also a crystalline catechin body.

The red colouring matter is mainly in the epidermis and the active principles are mostly in the starchy layer beneath it (Dalziel, 1936).

Dry cola usually contains between 1.1% and over 2% caffeine, and 50% nutritive matter. (Cola nuts used by British pharmacists (non official) have 2-2½ of caffeine (Dalziel, 1936). Irvine (1961) gives the following nutritive matter in Cola nitida:

Protein = 1.5%, Fat = 0.6%, Calcium 3.1%

Iron = 1.4%, Vitamin A = 31%, Thiamin = 11%

Riboflavin = 47%. Nicotinic acid = 0.7%, Ascorbic acid = 9.8%

The kernel contains about 1.6% tannin (Howes, 1953).

According to Sarpong (1953), Cola acuminata obtained from two sources, Kade and Bunso, were examined for their purine bases. The samples were analysed quantitatively and qualitatively by Chromatography and ultra-violet spectrophotometry respectively. The results showed that the average caffeine content of the nuts varied from 0.75% and 2.21% and the theobromine content from 0.07% to 0.43% among the different varieties examined. None contain theophylline.

Although all these varieties show the presence of caffeine and theobromine, their quantitative distribution varies consistently and therefore these varieties appear to constitute different genotypes (Sarpong & Santra, 1975).

7. HARVESTING, CONSERVING and PREPARATION

After plucking the fruits from the tree, the seeds or nuts are extracted from the follicles and the white aril removed after fermentation. This is effected either by burying them in the ground or by packing them in baskets lined with leaves and keeping them moist by periodic watering. The nuts are re-packed in baskets lined with broad leaves and kept in a cool place for a few days during which period the bad nuts may be removed before they are sent to the market for sale.

Cola nut dealers buy the nuts in large quantities from the producers, re-sort them and pack them finally in sacks for export. The leaves usually used in lining baskets for the storage of cola nuts are those obtainable from Alchornea cordifolia, Anthocleista spp, Mitragyna spp. and Marantaceae species.

8. ECONOMICS AND MARKETING

Cola nuts have ready markets both locally and overseas. The price of the nuts has gone up considerably in recent years due to the increase in demand.

9. SILVICS

Cola nitida is a shade bearer, but it develops a better spreading crown which yields more fruits when growing in open places. The seeds are very liable to worm attack and therefore natural re-generation is not common in the High Forest; however, it has been widely cultivated in farms and around villages. It is cultivated mostly by seeds which take about 3-4 weeks to germinate. The seedlings are sometimes raised in pots or in polythene bags before they are planted out. The tree can be propagated also by cuttings - not very successfully according to Bodard (1962), but aerial layering is successful.

10. MAJOR DISEASES

The nuts are subject to attack by the Kola weevil Balanogastris cola. The larvae of the moth Characoma strictigrapta which also attack cocoa, bore into the nuts. Traders sometimes apply an extract of the bark of Rauvolfia vomitoria or the pulverised fruits of Xylopia and Capsicum to counteract the attack on nursery plants. A leaf-sewing insect Sylepta semifugens causes much damage in some plants. The cocoa pests Sahlbergella spp have been found also on Cola nitida trees as an alternative host plant (Dalziel, 1936).

11. OTHER USES

Moslems consider cola nuts as sacred and brought by the Prophet Mohammed (Irvine, 1961). They use the nuts on ceremonial and social occasions.

The sapwood is pinkish-white and the heartwood dull yellow. It is subject to borer attack.

Although the wood is considered non-valuable in Ghana, it is said to be used elsewhere for furniture, house and boat building, coach-work, plates, domestic utensils and carving (Irvine, 1961). The insoluble parts of the leaf ashes are used in snuff-making in Ghana (Portères, 1950).

12. BIBLIOGRAPHY

Bodard, M. (1962) — Contribution a l'étude systematique du genre Cola en Afrique occidentale Dakar: Ann. Fac. Sci., Univ. Dakar 17.

Cudjoe, F.S. (1969) — A key to the family Sterculiaceae. F.P.R.I. Technical Note No. 7. Kumasi.

Dalziel, J.M. (1937) — The useful plants of West Tropical Africa. London; Crown Agents.

Goris, M. (1911) — Etude chimique et pharmacologique de la noix de Kola in Chevalier, A. & Perrot, E. Les kolatiers et les noix de Kola. Les végétaux utiles de Afrique tropical français Vol. 6. Paris: A Challamel édit.

Heckel, E. (1893) — Les kolas africains

Heckel, E. & Schlagdenhauffen, F. (1883) — Des Kolas africains aux points de vue botanique, chimique et thérapeutique - (Journal Physique et Chimique) V, no: 556-567, 8: 81-96, 117-208, 289-306.

Howes, F.N. (1953) — Vegetable tanning materials. London: Butterworth.

Irvine, F.R. (1961) — Woody plants of Ghana. London: Oxford University Press.

Keay, R.W.J., Onochie, C.F. and Standfield, D.P. Nigerian Trees Vol. 1 Lagos: Federal Govt. (1960)

Knebel Die bestanolfheile der Kolanuss. Apotex. Zeit 7: 112 (1961)

Porteres, R. Les sels alimentaires. Gouv. Général de l'Afrique occidentale française. Direction général de la Sante Publique, Dakar, 77 pp. (1950)

Sarpong, K. Studies in the Cola species of Ghana. Proc. Ghana Science Association 8th Biennial Meeting, Accra. (1974)

Sarpong, K. and Santra, D.K. Ghana Science Abstr. Vol. 1 No. 2. C.S.I.R., Accra. (1975)

Shapara, O. ex. Dalziel, J.M. The useful plants of West Tropical Africa p. 103. (1936)

PLATE XII. Cola nitida (Vent.) Schott and Endl.

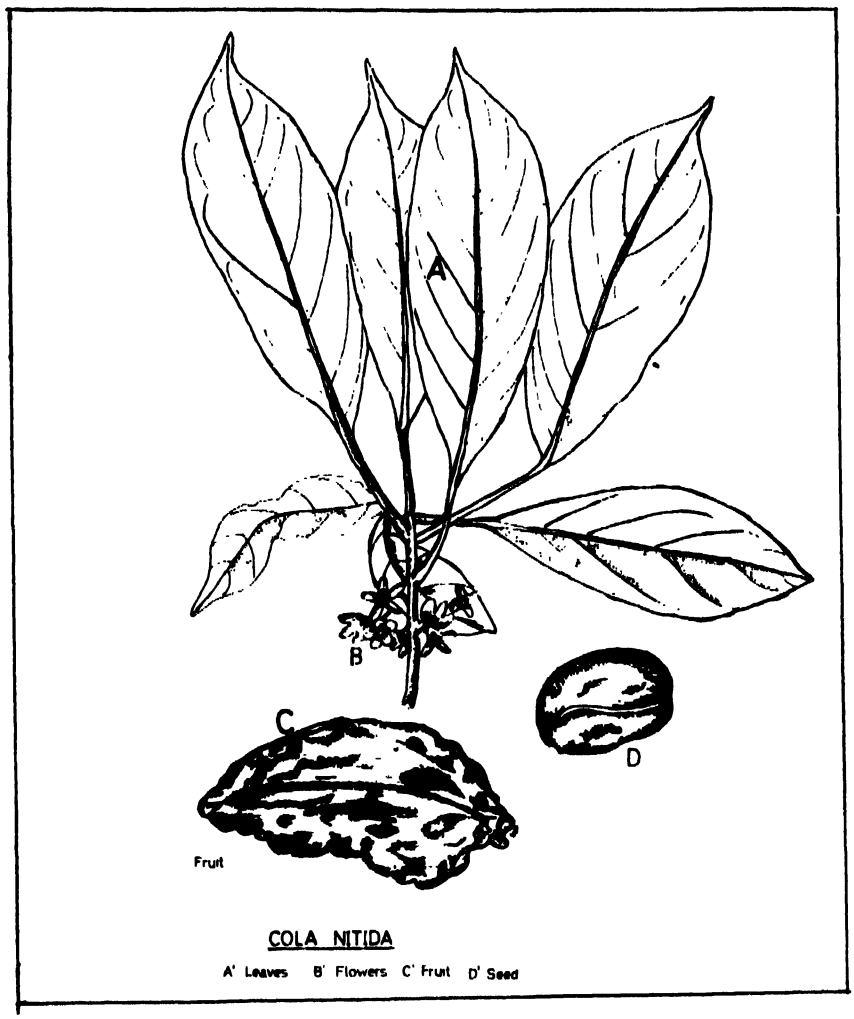


Plate XII. Cola nitida (Vent.) Schott and Endl.

A. leaves

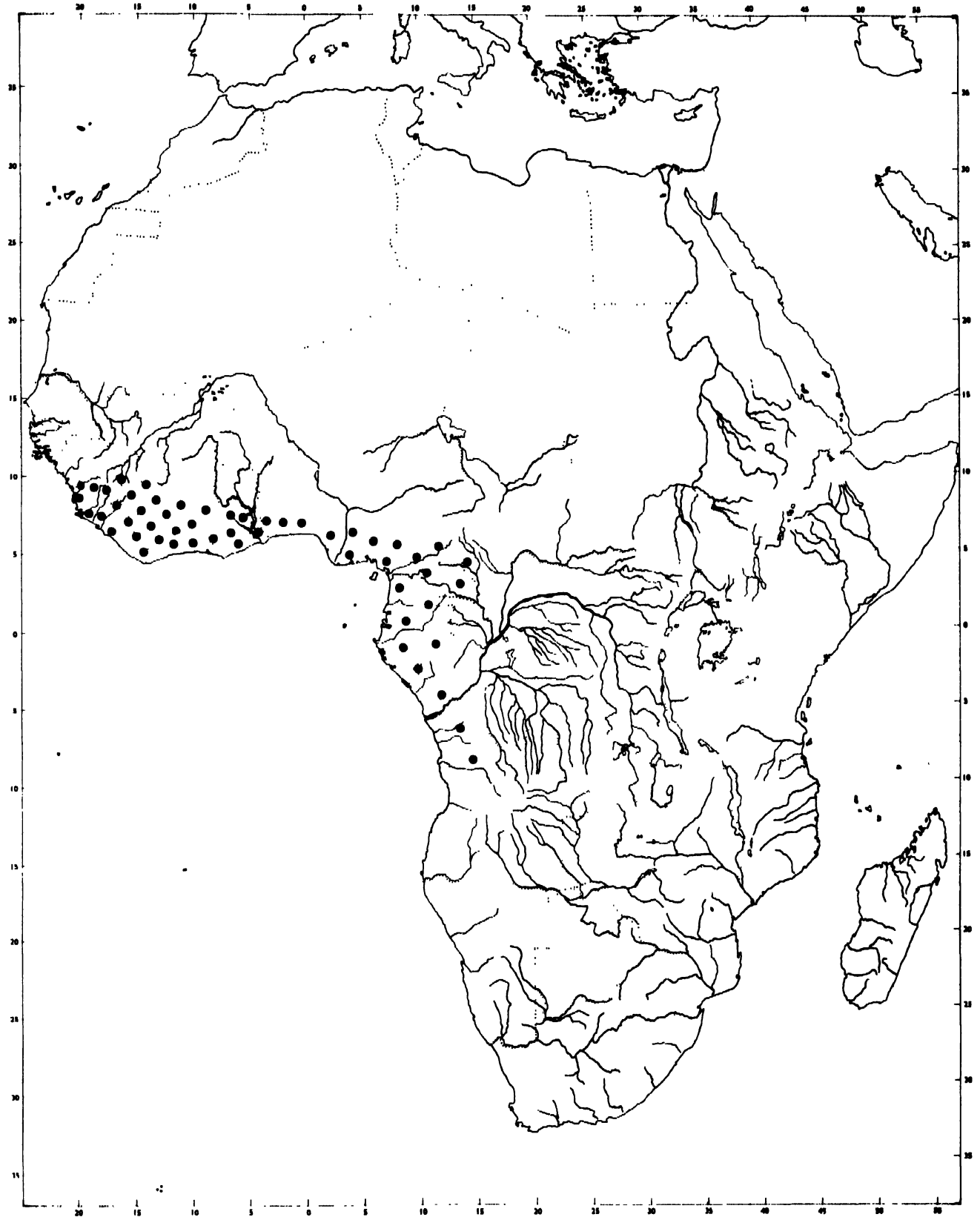
B. flowers

C. fruit

D. seed

Plate XII-1 Photo of dried herbarium specimen of Cola nitida

MAP 12 - Geographic distribution of Cola nitida



1. BOTANICAL NAME: Entada abyssincia Steud. ex A. Rich

SYNONYMS: Pusaetha abyssinica (Steud. ex A. Rich.) Kuntze
Entadopsis abyssinica (Steud. ex A. Rich.) Gilb. & Bout.

FAMILY: Leguminosae subfamily Mimosoideae

COMMON NAMES: Ekur, Sankwituri (Ashanti), Sankasaa, Kuboya (Bron), Chienchienga, Zuguli-kukui (Dagbani); Ghengbe (Yoruba), Angaramiri (Ibo); Umusange, Umusangasange (Rwanda); Mfutambula (Kinyamwezi), Ijwejwe (Kirangi), Musangisangi (Kizinza), Mubunda (Kibende), Mvulamvula (Kiluguru), Msarwa (Kikuria), Mwegambula (Kirongo), Mfufumasimba (Kibondei), Mugelagela (Kihene), Mumbu, Musagaruzi (Kinyaturu) Katutet (Nandi), Musiembu, Masiembet (Sebei), Musamba (Kakamega), Mulalatanga, Mulalatete (Bemba) Mukumbwangombe (Kaonde), Fumbwamusowo (Lozi), Muzenze (Lunda), Chisekele, Chongololo (Nyanja), Musenzenze, Munyele (Tonga).

2. ECOLOGY AND DISTRIBUTION

Entada abyssinica is a widely distributed savanna species occurring on a variety of soils from loams to clay loams and sometimes friable clays over laterite at altitudes from 60m to 2290m. The mean annual rainfall is between 500 and 1270mm.

The species is widely distributed in tropical Africa, being found in Mali, Guinee, Sierra Leone, Ivory Coast, Ghana, Burkina Faso, Togo, Dahomey, Nigeria, Cameroun, Central African Republic, Zaire, Rwanda, Burundi, Sudan, Ethiopia, Uganda, Kenya, Tanzania, Mozambique, Malawi, Zambia, Zimbabwe and Angola (see distribution map).

3. DESCRIPTION

A deciduous tree 3-10(-15)m high with flat, spreading crown; bark grey to reddish, slightly fissured, flaking off in irregular patches; slash pink, with streaks of red; branchlets pendulous, glabrous or sometimes pubescent. Leaves alternate, bipinnate, stipules absent; pinnae 1-22 pairs, leaflets 15-55 pairs, mostly linear-oblong, 3-14mm long, 1-4mm wide, apex rounded to slightly obtuse and slightly mucronate, appressed-pubescent above and below or sometimes glabrous above, rarely entirely glabrous; petiole eglandular. Inflorescence 1-4 axillary racemes 7-16cm long (including the 0.4-1.5cm peduncle). Flowers creamy-white fading yellowish, sweet-scented. Fruit a large flat legume 15-39cm long, 3-9cm wide, subcoriaceous, straight or nearly so with no conspicuous seed segments. Seeds oval, flat, 10-13mm long, 8-10mm wide; pod splitting between each seed, leaving the pod-rim and forming a wing to the seeds.

Flowering takes place during the rainy season and the fruit ripens towards the end of the rainy season extending into the dry season.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

On the basis of literature reviewed it is not known whether there are established medicinal and pharmaceutical uses.

5 FOLK MEDICINAL USES

Kokwaro (1976) observed that a decoction of the roots is drunk to alleviate rheumatic pains.

According to Watt and Breyer - Brandwijk (1962) the plant is used in the treatment of miscarriage; the leaf is used against fever.

A decoction of the bark is taken for chronic bronchial engorgement and is also used for abdominal pain. The juice of the bark and of the cambium have been used as ordeal poisons under the eyelid. A decoction of the stem bark is used for coughs.

The seed is used as an ophthalmic remedy. It is heated until it "pops" and the contents are ground into powder before use.

6. MAJOR CHEMICAL CONSTITUTENTS AND MEDICINAL PRODUCTS

Watt and Breyer - Brandwijk (1962) report that the root contains a saponin, entada saponin, and an alkaloid.

7. HARVESTING, CONSERVING AND PREPARATION

E. abyssinica leaves are plucked, pounded and an infusion prepared ready for use or boiled to form a decoction. Leaves are not conserved.

The tree is debarked and the bark is boiled to form a decoction. Roots are excavated, cut into small pieces and boiled to form a decoction which is drunk. The bark and roots are dried in the sun and stored in a dry place.

8. ECONOMICS AND MARKETING

There have been no economic studies on the exploitation of E. abyssinica. These are prospects that in future the plant's products could be marketed especially when the actual effective constituents have been isolated, preserved and used on a large scale in modern medicine.

9. SILVICS

The species regenerates naturally from suckers, coppices and seed. Root suckers are produced if the root is wounded.

Pretreatment of the seed is sometimes necessary because of the hardness of the seed coat.

The species prefers open areas, so slashing of herbaceous vegetation in its natural habitat might boost its growth and yield.

There have been no efforts to regenerate the species artificially. However, with suitable pretreatment of the seed it is possible to raise it in the nursery. It is suggested that the planting site should be cleared and slashing should be carried out especially a few years after planting.

10. MAJOR DISEASE

None specified.

11. OTHER USES

In the Shinyanga district the plant is used in rain-making and other ceremonies. It is also used as fuelwood.

12. BIBLIOGRAPHY

Anon (1976) Atlas of the United Republic of Tanzania. Surveys Division. Min. of Lands. Dar es Salaam.

Brenan, J.P.M. and Greenway, P.J. (1949) Check-Lists of the Forest Trees and Shrubs of the British Empire No. 5.

Kokwaro, J.O. (1976) Medicinal Plants of East Africa, E.A. Literature Bureau. Nairobi.

Morgan, W.T.W. (1972) East Africa: its peoples and resources. Oxford University Press. Nairobi. 312.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa E & S Livingstone Ltd. London. 1455.

Dale, I.R. and Greenway, P.J. (1961) "Kenya trees and shrubs" Government of Kenya and Hatchards. 187 Piccadilly London W.I.

PLATE XIII. Entada abyssinica A. Rich.

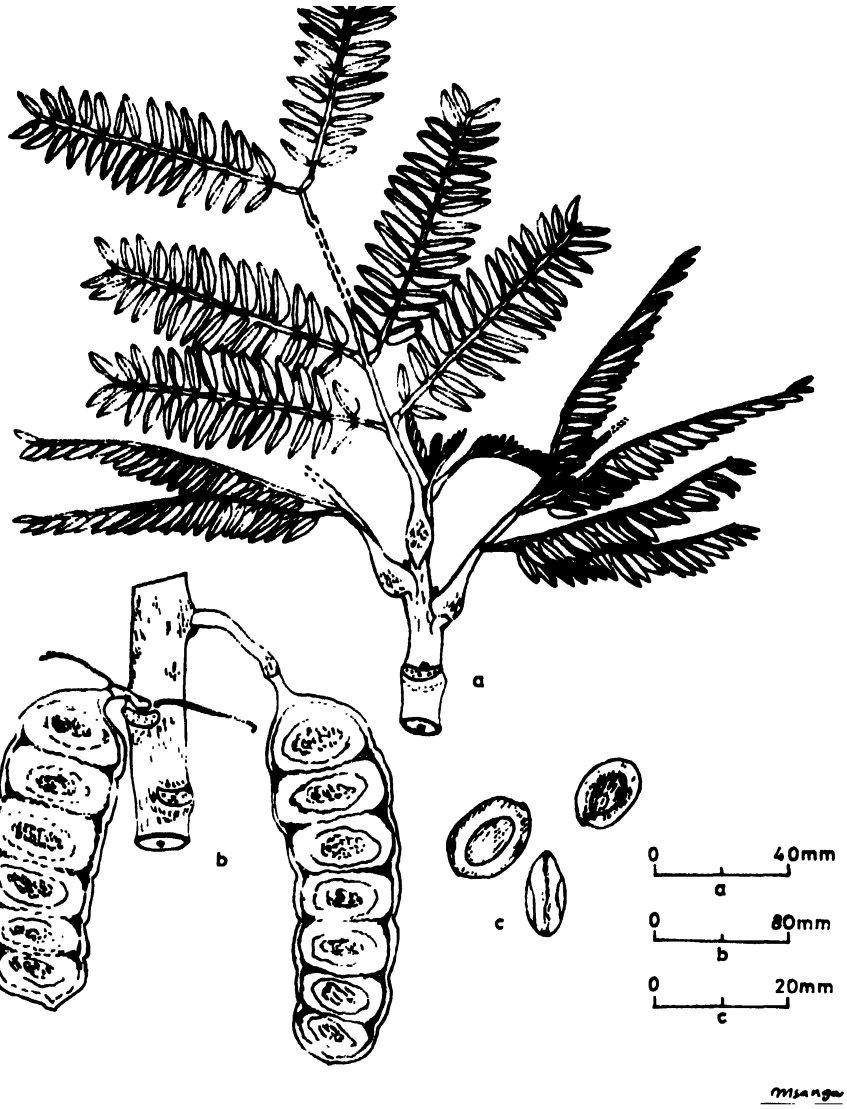


Plate XIII

Entada abyssinica

a. branchlet

b. portion of branchlet bearing pods

c. seeds

Plate XIII-1

Tree at Urumwa Forest Reserve, Tabora
Sept. 1983
(Photo Ruffo)

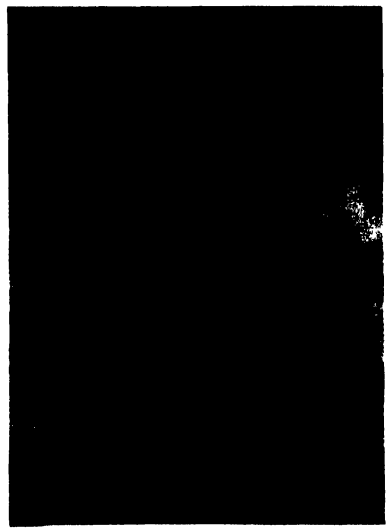
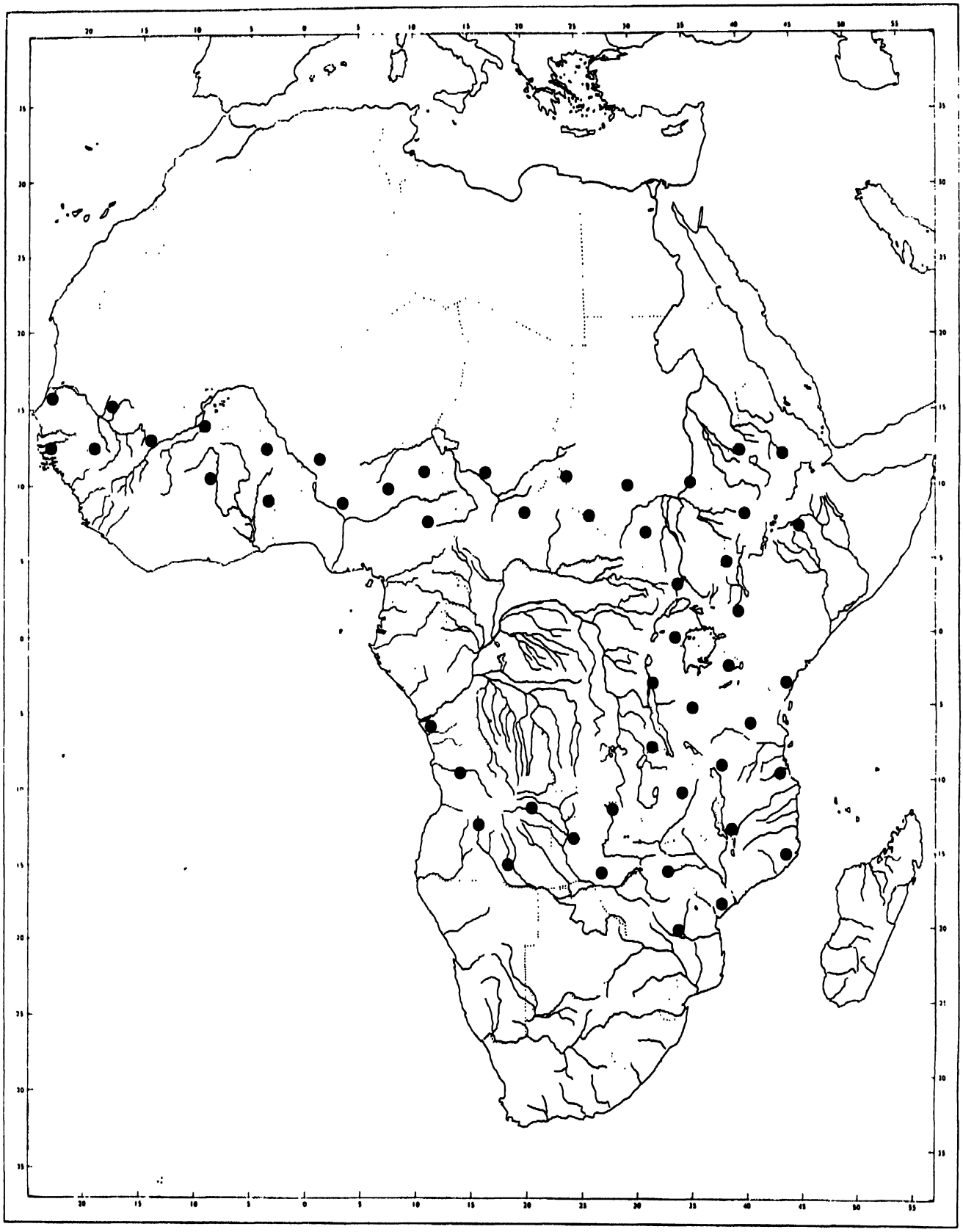


Plate XIII-2

branchlet bearing
mature pods
(Photo Ruffo)

MAP 13 - Geographic distribution of Entada abyssinica



1. BOTANICAL NAME: Erythrina americana Mill.

SYNONYMS: Erythrine carnea Ait. non Blanco
Erythrina enneandra R.Br.
Erythrina fulgens Lois.
Corallodendron americanum (Mill.)Kuntze

FAMILY: Leguminosae subfamily Papilionoideae

COMMON NAMES: Colorin, Gasparito, Pito, Madre mansa (Spanish); Tzompantlimazaixtle "stage eye", Tzompanquahitl "tree of coral beads" (Aztec).

2. ECOLOGY AND DISTRIBUTION

Erythrina americana occurs locally, probably on limestone, in the thorn forest belt, around the edge of the Balsas basin in Morelos and adjoining Puebla, south to northeastern and central Oaxaca to the headwaters of the Rio Papalcapan (Puebla and Oaxaca) and just across the divide to the edge of Veracruz (Orizaba) at altitudes between 500 and 2500m.

An endemic of central Mexico (Veracruz, Hidalgo, Mexico and Federal District, Morelos, ?Guerrero, Puebla, Oaxaca) and probably introduced elsewhere in Mexico. Also introduced into southern USA, Hawaii, Cuba, Europe and probably elsewhere (Krukoff and Barnaby, 1974). (See distribution map.)

3. DESCRIPTION

A small to medium sized tree up to 9m high, armed with spines; branches stout. Leaves alternate, 3-foliate; stipules present; petiole 4.5-23cm long; terminal leaflet larger, rhombic-ovate or rhombic-orbicular, 4.4-13cm long, 4.2-12cm wide, apex acute or obtuse, base broadly cuneate or rounded or trucate, margins entire, subcoriaceous, petiolules 5-11mm long. Inflorescence racemose; flowers showy, irregular; pedicels 2-5mm long, bracts 0.9-2.7mm long, 0.4-1.3mm wide. Calyx campanulate or tubular-campanulate, 9-21mm long; petals bright red, standard narrowly elliptic, 46-84mm long, 7-15mm wide, wings exceeding the keel petals, 11-19mm long, 2-4mm wide; stamens 42-64mm long, free for 10-26mm. Fruit a subwoody legume, 14-31cm long, 1.5-1.9cm wide, shallowly to sometimes deeply constricted between the seeds, more or less straight; seeds 3-6, scarlet with a black line extending from the hilum for 1-2mm, ovoid, 10-15mm long, 6.5-9mm wide (Krukoff, 1939).

The flowers appear with the leaves beginning of February.

The species is often confused with E. berteroana Urb., E. coralodendrum L. and E. coralloides A.DC., which are all known by the same common name "colorin".

4. ESTABLISHED MODERN PHARMACEUTICAL USES

It has been observed that intravenous injection of the alkaloids of Erythrina produces paralysis of all the skeletal muscles. It has been ascertained that, as in the case of curare, the paralyzing effect is the consequence of synaptic blockage of the nervous impulse travelling towards the skeletal muscle. The central nervous system is not involved. Unlike curare, which is excreted in the urine, alkaloids of Erythrina are excreted in various ways and the paralyzing effect is useful in various surgical procedures in which temporary but effective muscular relaxation is required.

The mechanism of these substances is related to the chemical competence that they establish as colinergic receivers with acetilcoline, the neurotransmitter of motor function.

It has also been demonstrated that beta-eritroidine competes with acetylcoline and that its curare-like effect is inhibited if quaternization of the nitrogen in its molecule is artificially modified. Eritroidine and its derivative dihydro-beta-eritroidine have been used in medicine as muscular relaxers, although their diffusion has not achieved the necessary recognition. At present these compounds are used to assist relaxation in anaesthesia for surgical purposes, since they enable excellent relaxation of the muscles, particularly of the abdominal wall, to be obtained, and this in turn implies the use of lower quantities of anaesthetics.

Research into relaxing drugs which are selective and block the ganglions continues in the search for better drugs; the pharmacological properties of colorín therefore continue to interest medical circles and it remains one of the products potentially useful in the medicine of the future.

5. FOLK MEDICINAL USES

The use of E. americana in medicine is the result of very recent studies, although according to popular tradition its roots and leaves were used as sudorifics and its flowers as expectorants. However, the use of E. americana for medicinal purposes began in the last century owing to the study made of its seeds by Mexican doctors investigating the reasons why the people considered them poisonous.

6. MAJOR CHEMICAL CONSTITUENT AND MEDICINAL PRODUCTS

The first record of this plant as a therapeutic resource appears in the Nueva Farmacopea Mexicana of 1874. It was reported that alkaloids were present in colorín seeds, in the form of an impure product called eritrocoraloidine. Later the alcoholic extract of eritrocoraloidine was tested in experimental animals and it was concluded that the action of this product was very similar to that of curare, it being observed that it produced paralysis of the muscles without affecting the brain or the medulla. The term "Mexican curare" was therefore used to refer to Erythrina and knowledge spread of the paralysing properties of extracts of seeds of the species americana, coralloides and others. The plant continues to interest Mexican scientific circles; the presence was reported of two new alkaloids, eritroidine and corialine, to which paralysing properties were attributed. Because the products obtained from E. americana and E. coralloides behaved in a similar way to Amazonian curare, considerable chemical research into the various species of Erythrina was carried out in other countries during the first half of the present century.

Some ten years ago, one of the alkaloids of Erythrina already described was isolated: eritroidine, a crystalline and biologically active product extracted from the seeds of E. americana. Later studies showed that eritroidine consisted of a mixture of two isomeric alkaloids, alfa and beta eritroidine, the structure of which was determined.

Now about 30 alkaloids are known to exist in various species of the genus, and it has been determined that this whole iso-quinoline-type group is responsible for the biological activity of the extracts of colorín seed. Of these alkaloids the following have been isolated in pure form and identified: eritraline, erisopine, erisovine, alfa and beta eritroidine, dehydroerisodine, eritramine, ertratine and erisonine.

7. HARVESTING, CONSERVING AND PREPARATION

Leaves and bark and flowers collected locally.

8. ECONOMICS AND MARKETING

No information available, probably marketed by herbalists.

9. SILVICS

It can be grown readily from seeds and from cuttings.

10. MAJOR DISEASES

None specified.

11. OTHER USES

In Mexico, in zones with a hot climate it is grown together with Erythrina coralodendron to provide shade for coffee and cacao bushes. Its flowers and those of various related species are used in Mexico for food purposes; mixed with fried eggs, they constitute one of the main dishes in Veracruz and the surrounding area.

According to the ancient chronicles, Erythrina was one of the plants classified by Aztec botanists, being given the name Tzompantli-mazaixtle (stage eye) and tzompanquahitl, a term that was translated as "tree of coral beads", because its seeds, although like beans in form and flavour, are of such a colour that they might be taken for coral beads.

The texture of its wood and the beauty of its seeds made tzompantli valuable to the pre-Columbian Mexicans. Then, as now, the trees are grown around vegetable plots and houses; the bark provides a valuable yellow pigment which is used in colouring cloth, and the seeds are used to make colourful necklaces.

12. BIBLIOGRAPHY

Altamirano, F. (1876) — La Naturaleza. 3: 391.

Altamirano, F. (1879) — La Naturaleza. 4: 126.

David, J. (1964) — J. Neuropharmacol. 2: 193.

Deulofeu, V. et al. (1947) — J. Chem. Soc. 12: 486.

Folkers, K. and Unna, K. (1937) — J. Amer. Chem. Soc. 59: 1580.

Folkers, K. and Unna, K. (1938) — J. Amer. Pharm. Ass. Sci. 28: 1019-1028.

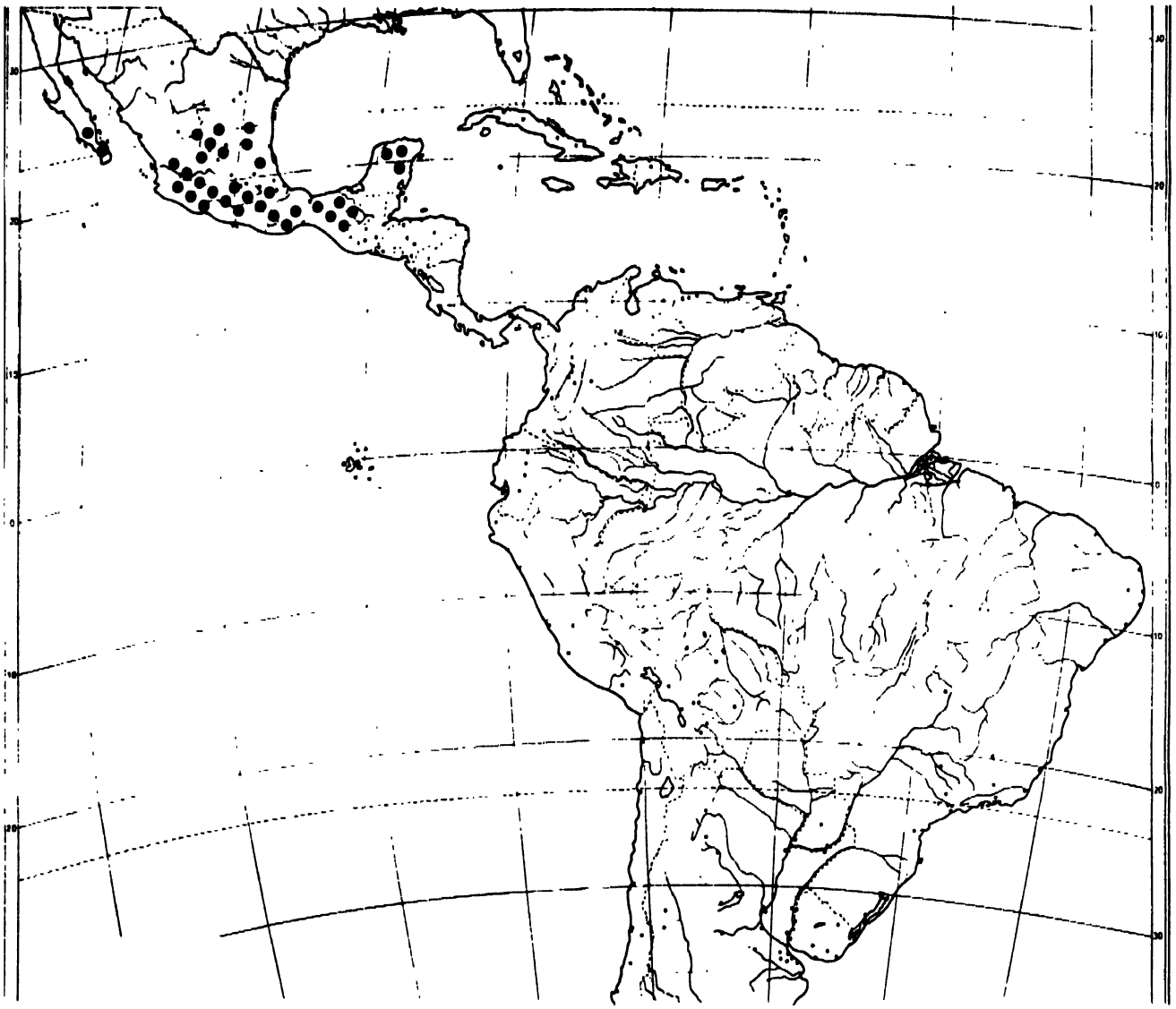
Folkers, K. (1941)	J. Amer. Chem. Soc. 63: 1544.
Ghosal, S. et al. (1971)	Aust. J. Chem. 24: 2733.
Hill, R. (1967)	The Erythrina alkaloids. The alkaloids Vol. 9. Academic Press. pag. 483.
Irwin, R. (1962)	J. Pharmacol. Exptl. Therap. 131: 242.
Kiraly, J. (1961)	British J. Pharmacol. 17: 242.
Koelle, G. (1975)	Neuromuscular blocking agents. En: The Pharmacological Basis of Therapeutics. Ed. Goodman I. & Gilman A. Macmill. Pub. Co. New york, pp. 574-588.
Lapière, C. (1949)	Bull. Soc. Chim. Biol. 31: 862.
Lapière. C. (1951)	J. Pharm. Belg. 6: 71.
Manske, R. (1973)	Alkaloids unclassified and of unknown structure. The alkaloids Vol. 14, Academic Press. pag. 507.
Morton, J.F. (1981)	Atlas of Medicinal Plants of Middle America, Bahamas to Yucatan; C.C. Thomas, Publisher, Springfield, ILL. USA.
Ramírez, E. and Rivero, M. (1935)	Anal. Inst. de Biol.: 301.
Río de la Loza, F. (1890)	El Estudio. 3: 159-165.
Ryall, R. (1964)	Nature. 201: 1034.
Schultes, R.E. (1982)	Plantas alucinógenas. Ed. La Prensa Medica Mexicana. pp. 96-97.
Smith, S.M. et al.	Anesthesiology. 8: 1-14.

PLATE XIV. *Erythrina americana* Mill.

Plate XIV. *Erythrina americana* Mill.

Leaves, fruits and flowers
(after O'Gorman H. (1963) Plantas y flores de México, UNAM, Mexico)

MAP 14 - Geographic distribution of Erythrina americana



1. BOTANICAL NAME: Jateorhiza palmata (Lam.) Miers

SYNONYMS: Menispermum palmatum Lam.
Cocculus palmata (Lam.) DC.
Menispermum columba Roxb.
Jateorhiza columba (Roxb.) Oliver
Jateorhiza miersii Oliver
Chasmanthera columba (Roxb.) Baill. ex Diels

FAMILY: Celastraceae

COMMON NAMES: Columba, Calumba or Calumbo; Kaomwa (Lindi, Konde), Mkaumwa (Swahili), Barbara (Boni), Colombo (Bombay), Kolumbu (Tamil).

2. ECOLOGY AND DISTRIBUTION

A liane of lowland rain-forest, riverine and montane forests and deciduous savanna woodlands, usually on alluvial soils at altitudes between sea level and 1500m.

In the absence of any published information the climatic parameters have been obtained by comparing the distribution of the species with the climatic diagrams of Walter & Lieth (1969). The inferred rainfall is 630-1525mm per annum with a short dry season. The mean annual temperatures are 19-26°C. It is inferred that Jateorhiza is unlikely to be frost tolerant.

An East African species native to Kenya, Tanzania, Malawi, Mozambique and Zimbabwe. Introduced in Ghana (Vide Irvine, 1961), Natal, Mauritius, India, Sri Lanka and Brazil (see distribution map).

3. DESCRIPTION

Liane, dioecious; red watery sap, branchlets densely pubescent at first, later strigose. Roots tuberous, yellow fleshed. Leaves alternate, petiolate, petiole 18-25cm long, strigose; lamina broadly rounded, deeply cordate at base, generally with 5 broadly ovate lobes, acuminate at apex, sometimes angular, 15-35cm long, 16-40cm wide, membraneous, clothed with strigose hairs on both surfaces, rarely glabrescent; basal nerves 5-7 palmate; petiole 18-25cm long, strigose. Male inflorescence of elongate axillary panicles up to 40cm long, strigose, lateral branches 2-10cm long, sometimes glabrous, with a linear-lanceolate ciliate bract at base; pedicals absent; flowers in 3-7 clusters. Male flowers with 6 greenish sepals, 2.7-3.2mm long, 1.3-1.6mm wide; petals 6, 1.8-2.2mm long; stamens 6, free, slightly adnate to the base of the petals, 1-1.8mm long, anthers globular, dehiscence transverse. Female inflorescence of axillary flowers; staminodes 6, tongue-shpaed; carpels 3, subovoid, 1-1.5mm long, rusty-pubescent. Fruit an ovoid or subovoid drupe, 2-2.5cm long, 1.5-2cm wide. (Troupin 1956, 1960).

Flowering throughout the rainy season, fruiting during the later rains and the dry season.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Calumba root is a bitter which has been used as a tincture or concentrated infusion in cases of atonic dyspepsia associated with hypochlorydria. Since tannins are absent, it can be given with iron salts. The drug is still current in national pharmacopoeias

(Martindale, 1982). Although alkaloids are present (see (6) below), the drug probably simply acts as a non-astringent bitter (Watt & Breyer-Branwijk, 1962).

5. FOLK MEDICINAL USES

In East Africa the plant is a remedy against dysentry and diarrhoea and it also finds use as a tonic (Bally, 1937). In India and other parts of Asia, it is again considered to be a tonic and it is also employed as an antipyretic and anthelmintic (Watt & Breyer-Brandwijk, 1962; Kirtikar & Basu, 1933). According to Oliver-Bever (1983) the tonic action is due to a stimulant or depressant action on the autonomous nervous system. The related species J. macrantha is used in Nigeria in the treatment of ulcers and snake-bite (Oliver, 1960).

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

2-3% Alkaloids are stated to be present in calumba root (Trease & Evans, 1978), but in more recent studies on the quaternary alkaloids only 0.8-1.2% crude bases have been isolated (Cava et al., 1965; Horn & Steffen, 1968; Carvalhas, 1972). The alkaloids are proto-berberines: of the total alkaloids, palmatine comprises between 50 and 96% and jatrorrhizine together with columbamine from 50 to 4%; berberine is absent (Cava et al., 1965; cf Thornber, 1970). Nothing is known about the tertiary bases of the plant. More recently, the quaternary dimeric base-jatrorrhizine, formed from the monomer by ortho oxidative coupling, has been isolated - it comprises a very small proportion of the alkaloid content of the root (Carvalhas, 1972).

Non-alkaloidal, diterpenoid bitter substances also occur in calumba root. The principal one is columbin (about 0.22%) and it is accompanied by the related substances chasmanthin and jateorin (Cava & Soboczenski, 1956; Hegnauer, 1969).

The proto-berberine alkaloids (including berberine) and their salts have antibacterial, as well as antifungal and antiprotozoal, properties; and they are effective in the treatment of cholera. The compounds also have anti-inflammatory and hypotensive activity (for references, see Bisset and Nwaiwu, 1983). A partially purified bitter-substance fraction is reported to have a synergistic effect on the antifungal activity of extracts and macerates of calumba root (Horn & Steffen, 1968).

Also reported to be present in the roots is 0.07-1.5% essential oil. Young roots contain more than old ones. On drying, most of the oil is lost (Hegnauer, 1969).

7. HARVESTING, CONSERVING AND PREPARATION

The roots and rhizomes are dug up during the dry season. The rhizomes are rejected while the roots are transversely or obliquely sliced and then dried in the shade. Unwashed roots are marketed as Natural Calumbo, roots cleaned by washing and brushing are known as Washed Calumbo. Washing can result in leaching, consequently importers prefer to do this themselves. The roots should be stored in a dry place. (Ashby, 1941; Anon. 1959). It is uncertain whether these observations are those of the cited authors or plagiarized from earlier reports dating back to the late eighteenth century.

8. ECONOMICS AND MARKETING

The calumbo root is reported to be an important industry in the Lindi District, Tanzania, where the roots are collected and exported to Europe (Williamson, 1956).

9. SILVICS

The root is apparently harvested from wild specimens. Berry (1808) records a successful attempt to grow from an offset; the stems die back annually after five or six months. Both male and female plants necessary if seed required. There appear to be no reports of any attempt to bring it into cultivation in East Africa. It has been introduced into Ghana (Irvine, 1961), Natal, Mauritius, etc., presumably to be grown under cultivation but apparently without success. Burkill (1935) reports four unsuccessful attempts to cultivate the crop in Singapore.

It was at one time exported from Columbia to Sri Lanka (hence the name) where it had been brought by (? East India Company) medical officers for treating stomach disorders (Woodville, 1794, Macmillan, 1943). There is no evidence that it is still present in Sri Lanka, indeed Ashby (1941) states that attempts to introduce it into both Sri Lanka and India were unsuccessful.

10. MAJOR DISEASES

None reported

11. OTHER USES

Root used as a flavouring agent in the formulation of liqueurs. Jackson (1902) observes that owing to serious stem damage to the English hop crop there was a considerable renewal of interest in the use of calumbo root as a substitute. The tuber is reported edible after cooking and pouring off the water (Zambia, ex sic. van Rensberg 2815 (K)).

12. BIBLIOGRAPHY

Anon (1959) — Jateorhiza palmata in the Wealth of India H-K: 292-293, New Delhi: Council of Industrial & Scientific Research.

Ashby, M. (1941) — Wartime drug supplies and European production II. Bull. Imp. Inst. 39,2: 106-124.

Bally, P.R.O. (1937) — Native medicinal and poisonous plants of East Africa. Kew Bull. 1937: 10-26.

Berry, A. (1808) — An account of the male plant, which furnishes the medicine generally called colombo or columba root. Asiatic Researches, 10: 385-388.

Bisset, N.G. and Nwaiwu, J. (1983) — Quaternary alkaloids of Tinospora species. Plant Med., in press.

Burkill, I.H. (1935) — A Dictionary of the Economic Products of the Malaya Peninsula 2 (I-Z). London, Crown Agents.

Carvalhas, M.L. (1972) — Bisjatrorrhizine, a new dimeric protoberberine alkaloid from Jatrorrhiza palmata (Lam.) Miers. J. Chem. Soc., Perkin I 1972, 327-330.

Cava, M.P. and Soboczenski, E.J. (1956) Bitter principles of plants. I. Columbin: preliminary structural studies. J. Amer. Chem. Soc. 78, 5317-5322.

Cava, M.P., Reed, T.A. and Beal, J.L. (1965) An efficient separation of the common alkaloids of the berberine group; the isolation and characterization of columbamine. Lloydia 28, 73-83.

Hegnauer, R. (1969) Chemotaxonomie der Pflanzen. Basel and Stuttgart: Birkäuser vol. 5, 86, 89, 91, 431.

Horn, L. and Steffen, K. (1968) Antifungale Wirkungen der Inhaltstoffe von Radix Colombo. Pharm. Ztg. 113, 945-950.

Irvine, F.R. (1961) Woody Plants of Ghana. London: Oxford University Press.

Jackson, J.R. (1902) Calumba root as a substitute for hops. Gard. Chron. III, 43: 433.

Kirtikar, K.R. and Basu, B.D. (1933) Indian medicinal plants, 2nd ed., E. Blatter, J.F. Caius and K.S. Mhaskar (eds.), Allahabad, L.M. Basu, vol. 1, 98-100.

Macmillan, H.F. (1943) Tropical Planting and Gardening ed. 5, London: Macmillan & Co. Ltd.

Martindale (1982) The Extra Pharmacopoeia, 28th ed., J.E.F. Reynolds (ed.), London, Pharmaceutical Press, 317.

Oliver, B. (1960) Medicinal plants in Nigeria, Ibadan: Nigerian College of Arts, Science & Technology, 29, 68.

Oliver-Bever, B. (1983) Medicinal plants in tropical West Africa. II Plants acting on the nervous system. J. Ethnopharmacol. 7: 1-93, 44.

Thornber, C.W. (1970) Alkaloids of the Menispermaceae. Phytochemistry 9: 157-187.

Trease, G.E. and Evans, W.C. (1978) Pharmacognosy, 11th ed., London, Baillière Tindall: 578-579.

Troupin, G. (1956) Flora of Tropical East Africa: Menispermaceae. London: Crown Agents.

Troupin, G. (1960) Menispermaceae in Flora Zambesiaca, A.W. Exell & H. Wild. (eds.) 1,1: 150-170. London.

Walter. H and Lieth, H. (1969) Klimadiagramm Weltatlas. Jena: Fischer.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa, 2nd ed., Edinburgh, E. & S. Livingstone, 757-758.

Williamson, J. (1956) Useful Plants of Nyasaland. Zambia: Government Printer.

Woodville, W. (1774) Medical Botany, Supplement, 164. London: J. Phillips.

PLATE XV. Jateorhiza palmata (Lam.) Miers

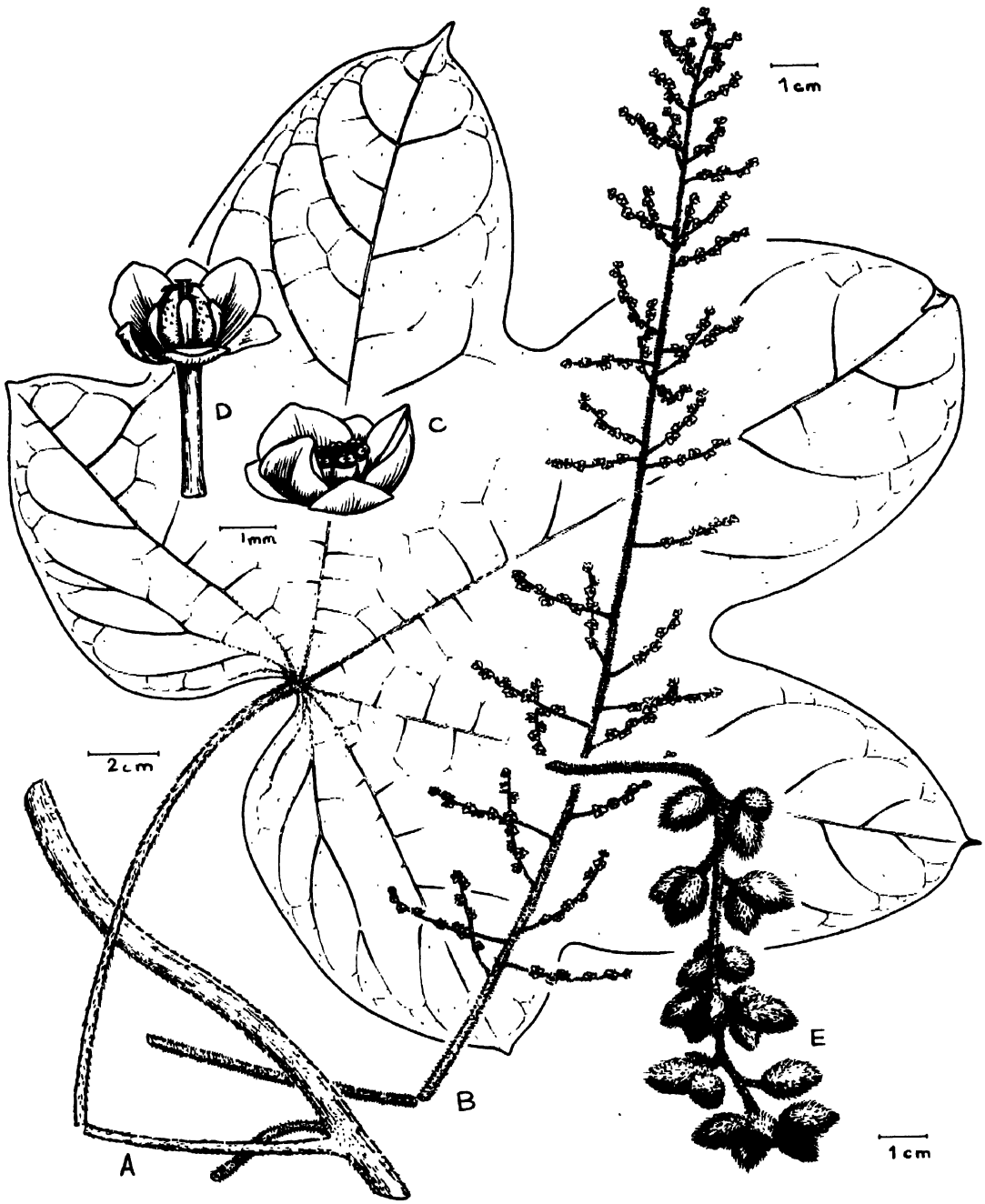
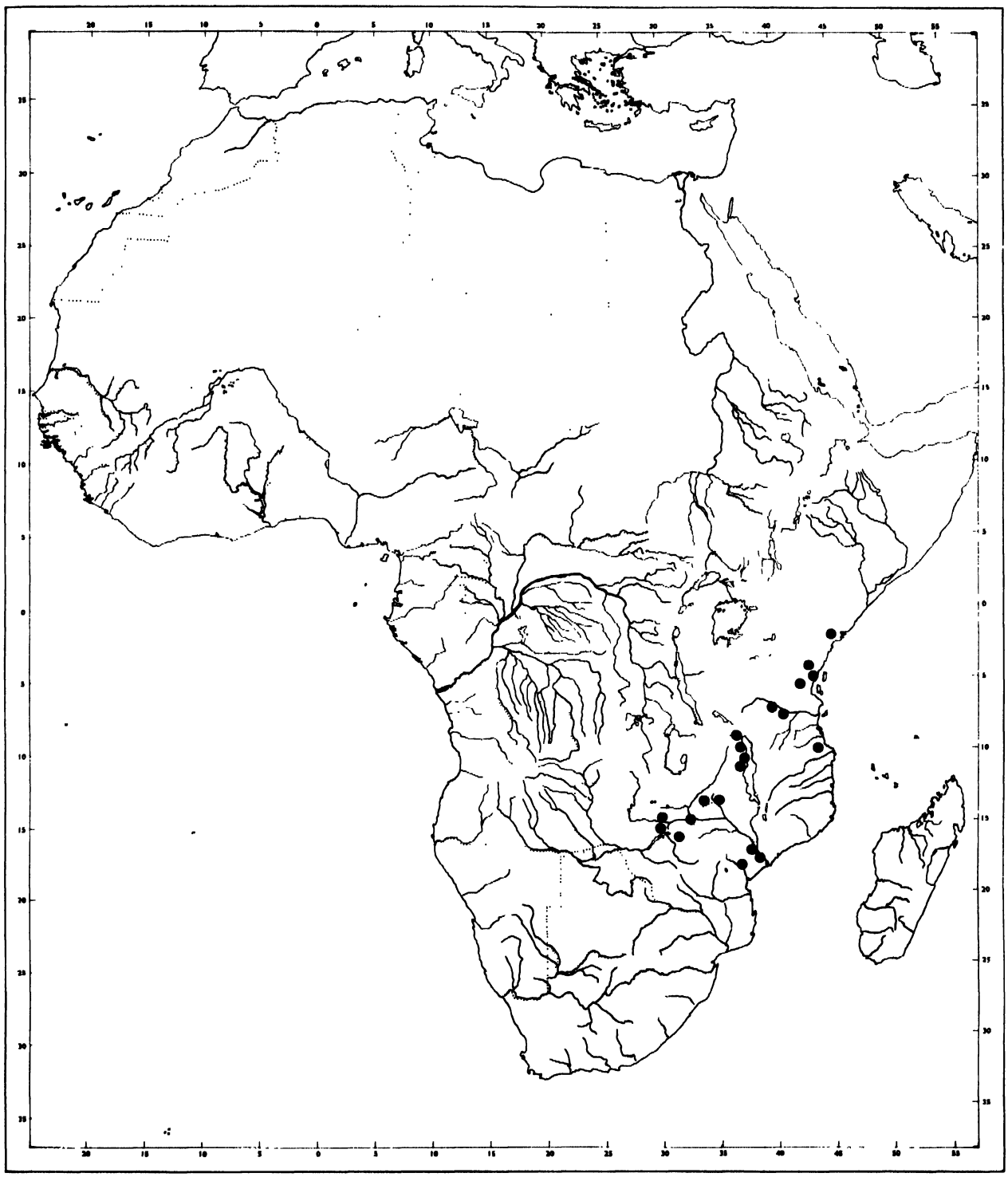


Plate XV. Jateorhiza palmata (Lam.) Miers

		Bar scale
A.	Leaf and stem	2 cm
B.	Male inflorescence	2 cm
C.	Male flower	1 mm
D.	Female flower	1 mm
E.	Infructescence	1 cm

MAP 15 - Geographic distribution of Jateorhiza palmata



1. BOTANICAL NAME: Jatropha curcas L.

FAMILY: Euphorbiaceae

COMMON NAMES: Physic nut, Pig nut; Aboroto, Nkrangyedua (Twi, Ashanti); Adadzi (Fante)

2. ECOLOGY AND DISTRIBUTION

Jatropha curcas is not native to Africa; it is believed to have been introduced from America into Africa and cultivated by the Portuguese. It is now widespread throughout the tropics and can be found in many tropical African countries, ranging from West Africa to East and Southern Africa (see distribution map).

It is very tolerant and thrives under a wide range of climatic and edaphic conditions. It is best suited to areas with a rainfall not below 1000mm per annum and temperatures not exceeding 40°C. It is very drought tolerant.

In Ghana Jatropha is usually used for fencing homes and gardens. Occasionally the tree is seen in villages and cemetries. It is never found in the high forest.

3. DESCRIPTION

Monoecious shrub or small tree up to 6(-8)m high; bark pale brown, papery, peeling slash exudes a copious watery latex, soapy to tough but soon becoming brittle and brownish when dry; branches glabrous, ascending, stout. Leaves alternate, palmate, petiolate, stipulate; stipules minute; petiole 2-20cm long, blade 3-5(-7)- lobed, 12.5-18cm long, 11-16cm wide, lobes acute or shortly acuminate at the apex, margins entire or undulating, leaf base deeply cordate, glabrous or only pubescent on the nerves below, basal nerves 7-9, prominent, venation reticulate. Inflorescence of pedunculate cymes 3-12cm long, peduncle 1-7cm long; flowers numerous, greenish yellow. Male flowers with articulate pedicel, sepals elliptic, 4-5mm long, petals elliptic-lanceolate, 6-8mm long, stamens 8-10; female flowers with sepals up to 18mm long, persistent; ovary 3-locular, ellipsoid, 1.5-2mm diameter, style 2-fid. Fruit an ellipsoid capsule 2.5-3cm long, 2-3cm in diameter, yellow turning black. Seeds 1 per cell, ellipsoid, triangular-convex, 1.5-2cm long, 1-1.1cm wide.

The plant sheds it leaves during the dry season but is never completely deciduous. In Ghana the flowering period is generally between April and May but may vary with some plants. The fruiting period is likewise variable but generally between July and August.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The seeds yield valuable oil and various parts of the tree are widely used for medicinal and other purposes. (Check list of the Gold Coast. p.46 - Forestry Department Gold Coast (Ghana).

The seeds owe their purgative property to the oil they contain (31-37 per cent). In Gabon 1-2 roasted seeds are sufficient to act as a purgative, if larger doses are used they may prove to be dangerous and act as an irritant poison (Walker, 1953). The seeds were formerly exported from the Cape Verde Islands to Portugal and the "curcas" or purging oil from them is a drastic purgative. It is an ingredient in the oily extract known in Hausa as "Kufi" which is used as a rubifacient for rheumatism and for parasitic skin conditions (Dalziel, 1937).The seeds have been substituted for castor oil and are sometimes called larger

castor oil.The minimum fatal dose is unknown as recovery is reported after the eating of as many as 15-20 seeds. The seeds resemble groundnuts in flavour and 15-20 seeds eaten at Somanya (Ghana) caused half an hour of griping, purging and vomiting (Irvine, 1961). The oil from the seeds is used in Java to stimulate hair growth and the poisonous resin is carried off in the oil during pressing. The oil therefore has vesicant properties (Dalziel, 1937).

The juice of the flowers has numerous medicinal uses (Aubreville, 1936).

A leaf decoction (0.10g./litre of water) is diuretic (Kerharo and Bouquet, 1950).

5. FOLK MEDICINAL USES

The seeds crushed and boiled with cereal pap are given to cause purgation in "ascites" etc. or 3-4 seeds roasted in ashes and mixed with natron or extract of wood ashes are taken with water or milk for the same purpose. In the treatment of "syphilis" the seeds are crushed and mixed with cereal food and left to ferment for 2 nights (Dalziel, 1937)

The juice or latex is applied directly to cuts and wounds as styptic and also applied to carious teeth; mixed with salt, it is rubbed on the teeth to clean them (Dalziel, (1937) The juice provides an astringent "kino". It is rubbed on childrens' gums on the Ivory Coast to help the teeth through (Kerharo and Bouquet, 1950). It is used similarly in Ghana and also applied to sores in the mouth or on the tongue to heal (Traditional). The viscid juice and pounded leaves are slightly rubefacient and are applied to sluggish ulcers. A lotion made from the crushed leaves is used in treating Guinea-worm sores or the ashes of the burnt leaves are applied to the sores (Dalziel, 1937).

The boiled leaves mixed with lime juice are drunk or used in washing for "yellow fever" (jaundice). The Ebris use the warm leaves for rheumatic pains. A decoction of the young leaves is also taken internally for fever while the Bakwiri of the Cameroon Mountains drink the same, added to beer as a "diuretic" for rheumatism (Santesson, 1926).

In Nigeria a decoction of the leaves with native natron is used by women as a wash for a month before child birth. In Gambia the leaves are used to make a mouthwash (Dalziel, (1937). In Ghana the leaves are a common ingredient in enema preparations and are prepared with palm fruits as an enema for weakly children (Dalziel, 1937).

A leaf infusion is used for bathing and as an enema in treating convulsion and fits (Saunders, 1961). A few leaves boiled with oil palm fruits and prepared together as palm soup is taken internally by pregnant women whose foetus cannot develop or move (Ankoma Ayew-Centre for Scientific Research into Medicinal Plants, Mampong-Akwapim, Ghana).

The dried and powdered root bark is applied to sores and with sorghum is rubbed on the gums to relive spasms of "infantile tetanus". The Anyis in the Ivory Coast make suppositories with the root pulp adding Xylopia fruits for dysentry. In Nigeria the leaves are a remedy for jaundice, applied by rectal injection (Irvine, 1961). In Ghana the ashes from the burnt leaves are applied by rectal injection on haemorrhoids or bleeding piles (Traditional Medicine).

6. MAJOR CHEMICAL CONSTITUENTS

The juice contains 10 percent tannin. The bark contains 37 percent tannin (Howes, 1953) and is said to yield a dark blue dye. The plant is listed as fish poison (Pammel, 1911). The bark contains wax composed of a mixture of "melisayl alcohol" and its melissimic acid ester (Watt and Breyer-Brandwijk, 1962).

The seed contains a "toxalbumen". In the albumen of the kernel is another poison most abundant in the embryo, the chief poison is "toxalbumen cursin". It is said not to cause the agglutination of the red corpuscles but it may harm the ducts and thus cause serious trouble (Kerharo and Bouquet, 1950). The seeds owe their purgative property to the oils they contain (31-37 percent) they are poisonous and are formed of esters of palmitic and stearic acids (10-17 percent), oleic acids (45-62 percent) Linolic acids (18-45 percent) and myristic(?) and arachidic acids (less than 1 per 1000) (Mensier, 1961). The husk of the seeds also contains poison. Curcin is related to ricin in Ricinus and crotin of croton tiglium, for symptoms of poisoning (Burkhill, 1935). A third poison, a resin (croton resin) occurs in the seeds and causes redness and pustular eruption of the skin (Burkhill, 1935).

7. HARVESTING, CONSERVING AND PREPARTION

The seeds are harvested, placed in heaps and allowed to dry and dehisce spontaneously. The seeds are then separated from the pericarp, dried, roasted and ground.

The grounds are boiled and the extracted oil, which floats on the surface, can be collected.

8. ECONOMICS AND MARKETING

It has been known to produce 350-1000lbs/acre (420-1200kg/ha) of oil seed. It was grown commercially in the Cape Verde Islands and the Malagasy Republic.

9. SILVICS

Jatropha curcas is easily propagated by seeds and by cuttings. It has been grown extensively in Ghana as fences and hedges, but has not been grown in plantations as reported in Senegal and the Cape Verde Islands.

10. MAJOR DISEASES

There are no records of disease or pests. It is believed to be avoided by termites.

11. OTHER USES

The sap contains 10% tannin and can be used as marking ink. The leaf juice stains red and marks linen indelible black. The dried seeds are put on sticks, and after being dipped into palm oil are used as torch which will keep alight even in strong wind. The oil from the seeds is used along with burnt plantain ashes in making hard home-made soap. It is also used to make soap in Zanzibar. The oil burns without smoke and has been employed for street lighting near Rio-de-Janeiro (Irvine, 1961, Dalziel, 1937).

In Europe the (semi-drying) oil is used in wool spinning. Soap is also made throughout West Africa from the wood ashes and in Ghana, from the leaf ashes (Irvine, 1961).

In Guinea the ashes from the roots and branches are used as cooking salt and in the dye industry (Porteres, 1950). The bark is said to yield a dark blue dye. It contains 37 percent tannin (Howes, 1953). The lates is used in the Philippines for stunning fish. The seeds ground and mixed with palm oil are used in Gabon to kill rats (Walker, 1953)

In Ghana the leaves are used to fumigate houses against bed bugs. The seeds are sometimes added to Strophanthus seeds to make arrow poison or used as an ingredient with Euphorbia latex in a mixture (gunguma-Hausa) for poisoning corn as a bait for guinea fowls (Dalziel, 1937).

The oil mixed with ashes is used in removing hairs from animal hides.

The pounded seeds are used in tanning leather in the Northern and Upper Regions of Ghana.

It is widely planted as a hedge plant (see 9).

12. BIBLIOGRAPHY

Aubreville, A. (1936) — La flore forestière de la Côte d'Ivoire, 3 Vols. Paris: Larose édit.

Burkhill, I.H. (1935) — Economic products of Malay Peninsula; London: Oxford Univ. Press.

Dalziel, J.M. (1937) — The Useful Plants of West Tropical Africa. London: Crown Agents.

Godin, V.J. and Spensley P.C.: (1971) — Oil and oil seeds; TPI Crop Products Digests No. 1. pp. 107-110.

Howes, F.N. (1953) — Vegetable Tanning Materials; London: Butterworth.

Kerharo, J. and Bouquet, A. (1950) — Plantes médicinales et toxiques de la Côte d'Ivoire - Haute Volta; Paris: Vigot édit.

Mensier ex Irvine, F.R. (1961) — Woody Plants of Ghana. p. 235.

Pammel, H. (1911) — A manual of poisonous Plants. Cedar Rapids, Iowa Torch Publications.

Porteres, R. (1950) — Les sels alimentaires. Gouv. Général de l'Afrique occidentale français. Direction Général de la Sante Publique, Dakar.

Santesson, C.G. (1926) — Einige drogen aus dem Kamerun - Gabiete und ihre einheimische Ver wendung. Archiv. fur Botanik 20.

Saunders, G. (1961) — Personal Comm. to Irvine, F.R. - Woody plants of Ghana p. 235.

Walker, Abbé A. (1953) — Usages pharmacéutiques des plantes spontanées du Gabon. Bull. Inst. Etudes Centrafr. Nos. 5 and 6.

Watt, J.M. and Breyer Brandwijk (1962) — The medicinal and poisonous plants of Southern Africa, Edinburgh, Livingstone.

PLATE XVI. Jatropha curcas L.

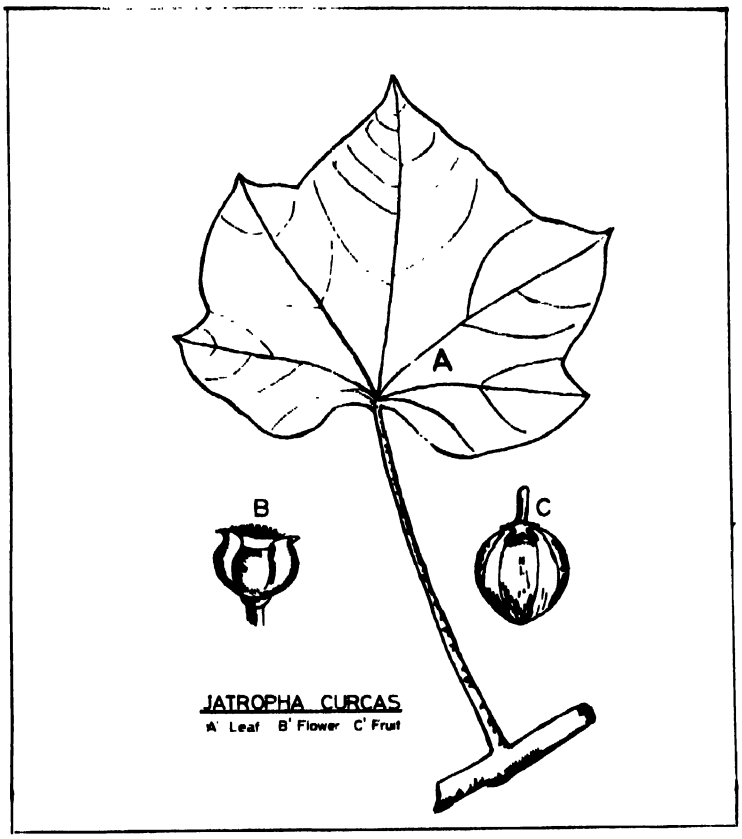


Plate XVI. Jatropha curcas L.

A. leaf

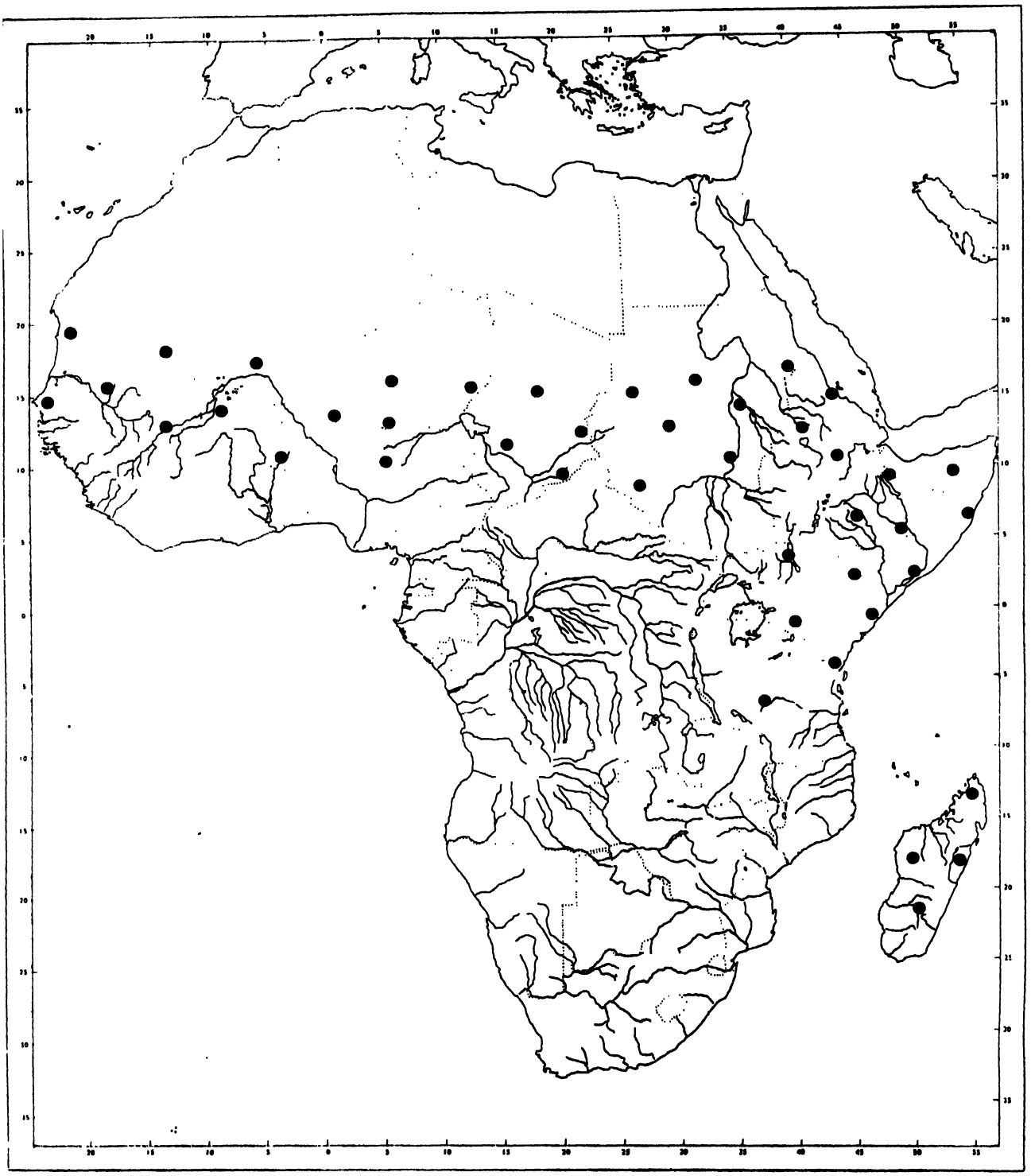
B. flower

C. fruit

Plate XVI-1 shrubby tree of Jatropha curcas

Plate XVI-2 branch with fruits

MAP 16 - Geographic distribution map of Jatropha curcas



1. BOTANICAL NAME: Khaya senegalensis (Desr.) A. Juss.

FAMILY: Meliaceae

COMMON NAMES: African Mahogany, Senegal Mahogany; Kuntunkuri (Ashanti), Korobaa (Bron), Koka or Koko (Dagarti, Mampridi Moshi, Nankani, Wala); Ono (Ibo), Ogonwo (Yoruba), Okpe (Itsekri), Kagam (Kanuri), Ha (Tiv), Dalehi (Fulani), Madachi (Hausa).

2. ECOLOGY AND DISTRIBUTION

Khaya senegalensis occurs in riverine forests and scattered within the higher rainfall savanna woodlands.

It extends from West Africa to the Sudan, occurring in Senegal, Gambia, Mali, Guinea, Guinea Bissau, Sierra Leone, Ivory Coast, Ghana, Togo, Dahomey, Niger, Nigeria, Cameroon, Central African Republic, Chad, Sudan and Uganda; it has been introduced into Malawi (see distribution map).

3. DESCRIPTION

A deciduous or overgreen tree 15-30m high, 1m in diameter, with a clean bole 8-16m, butresses not prominent or absent; bark dark grey, with small, thin, reddish-tinged scales; slash dark pink to bright crimson, exuding a red sap. Leaves alternate, compound, stipules absent; petiole and rachis 13-33cm long; leaflets 3-4(-7) usually opposite pairs, oblong to narrowly oblong-elliptic, 4-12cm long, 2-5cm wide, apex acute to shortly acuminate, base rounded, margins entire, pale green, lateral nerves 8-16, petiolules c.3.5mm long. Inflorescence a lax, much branchea axillary panicle up to 17cm long; flowers 4-merous, monoecious but with well developed vestiges of the opposite sex and with very little external differences between sexes. Calyx pale green, lobed almost to the base, lobes subcircular, c.1mm long, 1mm wide, imbricate; petals cream, free, oblong-ovate, 4mm long, 2.5mm wide, contorted in bud; stamens or staminodes 8, united into a tube; disk orange-red, cushion-shaped, fused to the base of the ovary but free from the staminal tube; ovary 4-celled. Fruit an upright, almost spherical, woody capsule, 4-6cm in diameter, opening by 4 valves from the apex; seeds 6 or more per cell, broadly transversely ellipsoid to flat, c.25mm long, 18mm wide, margins narrowly winged.

Flowering shortly before or early during the rainy season, the fruits apparently remaining on the tree throughout the dry season.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None known so far.

5. FOLK MEDICINAL USES

The bark is very bitter and has a considerable reputation among Africans as a fever remedy, and is even called "Quinquina du Senegal". The bark can be boiled and the decoction drunk at intervals as specified by the herbalist, fresh bark macerated in cold water and the infusion drunk, or the dry pulverised bark mixed with salt and taken in small doses every second day. The bark is also used as a vermifuge, taenicide, depurative and for treating syphilis. Crushed bark and seeds are regarded as emmenagogue.

The bark is also used in traditional veterinary practice. For cattle suffering from liver fluke and infusion made by steeping the bark in a mixture of bran and water is given as a draught. Dried and pulverised bark is used as a dressing for ulcers on camels, horses and donkeys; and a decoction of the bark is sometimes used as a lotion for any ulcer or wound. A concoction of the bark is given to horses for internal ailments associated with mucous diarrhoea.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The timber, bark, roots, leaves and seeds have been extensively examined. They contain the following specific limonoid compounds: khivorin, 7-ketokhivorin, 3-deacetyl-khivorin, 3:7-diacetylkhivorin, 3-deacetyl-7-ketokhivorin, 7-ketogedunin, methyl angolensate, methyl-6-hydroxy angolensate, mexicanolide, 6-hydroxy mexicanolide, 6-deoxy swietenolide esters, and khayasin. The last compound is characteristic and has been found in the timber of no other species.

n-Alkanes from C_{25} to C_{33}, with C_{29} and C_{31} as the most abundant, are present in the leaves.

The bark also contains 2,6-dimethoxy-p-benzoquinone, -sitosterol and its -D-glucoside, catechin tannins, and saponins.

The gum is rich in polysaccharides identified by Aspinall and co-workers.

7. HARVESTING, CONSERVING AND PREPARATION

Almost exclusive use of bark and occasionally seed.

8. ECONOMICS AND MARKETING

Local collection for domestic use.

9. SILVICS

Natural regeneration from seed is poor, though it grows well from seed and transplants well. It largely reproduces itself from suckers and is recommended for reforestation purposes.

10. MAJOR DISEASES

Unknown

11. OTHER USES

It is one of the common African mahoganies whose timber has been widely used on a commercial scale, particularly from West Africa. The wood is the hardest of the Khaya species and is also used in railway-carriage construction or for sleepers. The bark is used in tanning. The leaves are used as fodder for cattle and camels though not very palatable. The tree is used in the Ivory Coast as an ingredient in arrow poison. Bark scales are sometimes used as a fish poison. The timber of this species was the first known of the African mahoganies, and was exported from Gambia to Europe in the early part of the 19th century. The presence of oleo-resin in the vessels of Khaya species accounts for the durability of the timber and its resistance to insect and fungus attack.

12. BIBLIOGRAPHY

Adesida, G.A. et al. (1971) — Phytochemistry, 10, 1845 and references cited therein.

Faboya, O.O.P. et al. (1980) — Phytochemistry, 19, 1226.

Polonsky, J. and Lederer, E. (1959) — Bull. Soc. Chim. France, 1157.

Brocheré-Ferrérol, G. et al. (1958) — Compt. Rend., 246, 3082.

Moyse-Mignon, H. (1942) — Recherches sur quelques Méliacées africaines et leurs principes amers, Thèse Pharm., Univ. Paris.

Aspinall, G.O. et al. (1970) — J. Chem. Soc., C, 365 and previous works cited therein.

PLATE XVII. Khaya senegalensis (Desr.) A. Juss.

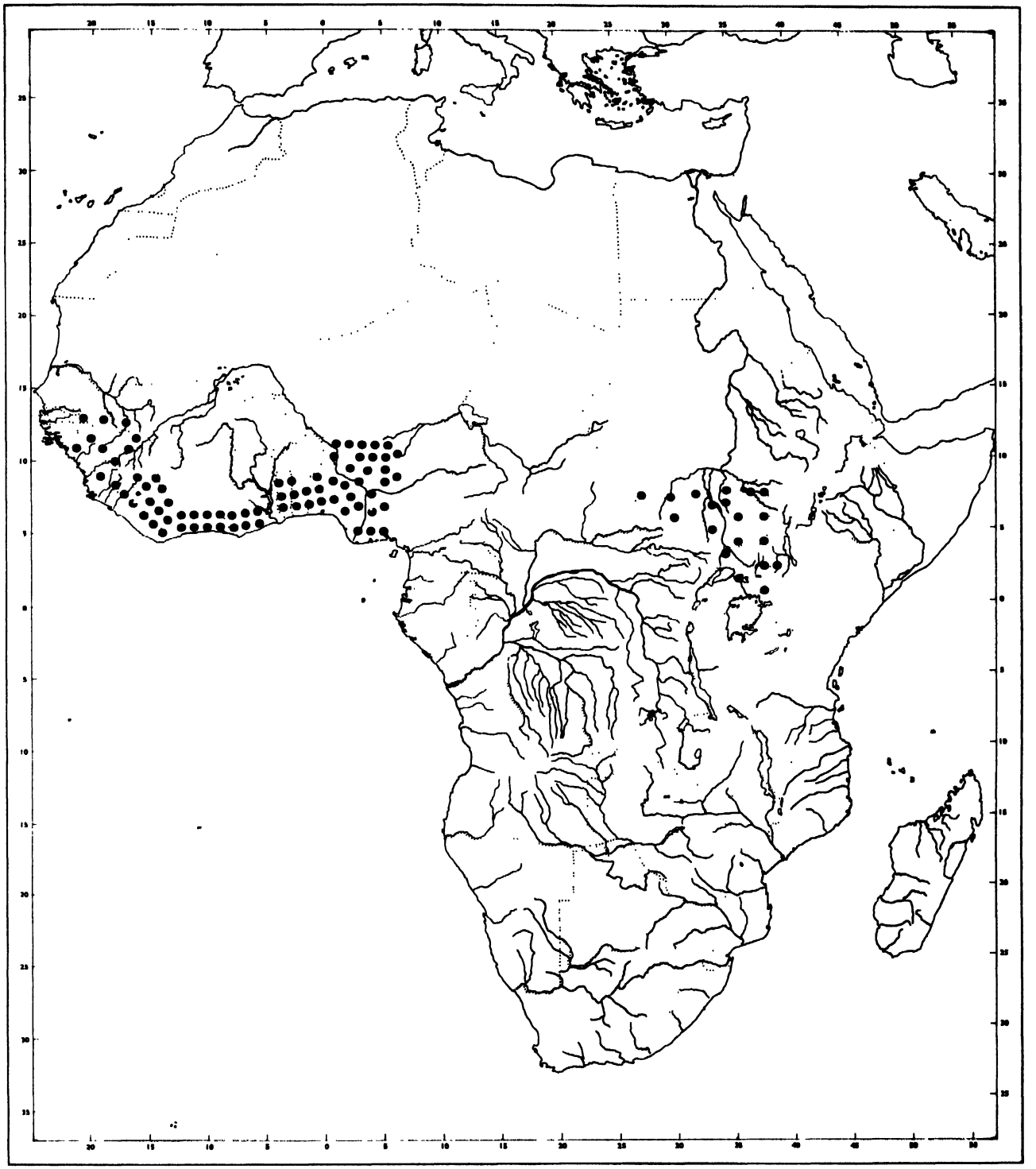
Plate XVII. Khaya senegalensis (Desr.) A. Juss.

A. flowering branch

B. longitudinal section of flower

C. fruit

MAP 17 - Geographic distribution of Khaya senegalensis



1. BOTANICAL NAME: Kigelia africana (Lam.) Benth.

SYNONYMS:
Bignonia africana Lam.
Kigelia abyssinica A. Rich.
Kigelia pinnata (Jaca.) Decne.
Kigelia acutifolia Engl. ex Sprague
Kigelia elliotii Sprague
Kigelia elliptica Sprague
Kigelia impressa Sprague
Kigelia spragueana Wernham
Kigelia aethiopum (Fenzl) Dandy

FAMILY: Bignoniaceae

COMMON NAMES: Sausage tree; Nufuten, Nanaberetee (Ashanti, Akwapem), Etua (Fante), Blimmo (Baule), Akpele (Ga), Lele (Adanme), Nyakpe (Ewe); Rawuya (Hausa), Jilahi (Fulani), Bulungu (Kanuri), Bechi (Nupe), Pandoro (Yoruba), Ugbongbon (Bini), Uturubein (Ibo); Abu Shutor, Abu Sidra, Um Shutur, Umm Mashatur (Arabic); Rangbarabgbo (Zande); muVeve (Tonga), muVumati (Ndau), muZunguru (Kalanga), mPolota (Lozi), umBvewe, iPfungwani, muBvee (Shona, Zezuru, Manyika), Mufungufungu (Bemba, Lozi), Munguli (Lozi) Muzungule (Lozi, Tonga), Kufungule (Kaonde) Ifungufungu, Mufunofuno (Lunda), Chizutu, Mvula, Mvunguti (Nyanja), Muratina, (Kikuyu, Meru), Muatini, Kiatine (Kamba),Mwasini, Mvongonia (Teita), Ol-Suguroi, Ol-Darpoi (Masai), Yago (Luo), Morabe (Kakamega), Mvungunya,Mvungavunga, Mwegea (Swahili), Muratini (Giriama), Mukisha (Taveta), Ratiunet (Nandi), Ratiunet (Kipsigi),Sheole (Boni).

2. ECOLOGY AND DISTRIBUTION

In Nigeria Kigelia africana occurs in moist evergreen and semi-deciduous forests,also in savanna mosaic and dry forest. Elsewhere extending into high rainfal savanna and riverine communities. Widely distributed in tropical Africa, occurring in Sevegal, Gambia, Mali,Sierra Leone, Guinée, Liberia, Ivory Coast, Ghana, Togo, Dahomey, Niger, Nigeria, Cameroun, Fernando Po, Gabon, Congo, Zaire, Rwanda, Burundi, Chad, Central African Republic, Sudan, Ethiopia, Somalia, Kenya, Tanzania, Zambia, Malawi, Zimbabwe, Botswana, Mozambique, Transvaal, Swaziland, Natal, Namibia, Angola (Innamorati 1971) (see distribution map).

3. DESCRIPTION

Deciduous tree to 24m, bark dark grey to light brown, scaly; slash creamy white with a green edge; low branching, branches and branchlets spreading, lenticellate. Leaves alternate, pinnate, stipules absent; rachis up to 50cm long; leaflets 3-6 opposite pairs, usually with a terminal leaflet, elliptic to elongated lanceolate, 7-20cm long, 4-12cm wide, apex abruptly to gradually shortly acuminate, base slightly asymmetrical, rounded to cuneate, margins entire or sometimes slightly toothed, coriaceous or papyraceous, shiny green and usually scabrid above, dull green, glabrous to tomentose below; midrib impressed above, major lateral veins 7-12 pairs, prominent below. Inflorescence lax pendulous panicles borne on the old wood, up to 90cm long; flowers hermaphrodite, more or less zygomorphic, 5-merous. Calyx campanulate, 1-4cm long, 1-2cm wide, fleshy, irregularly 5-lobed, the lower lobes generally longer at maturity and the calyx mouth thus oblique; corolla greenish yellow to purplish red or bright claret, 5-12cm long, the throat rather abruptly expanded, limb 9-18 across with the 2 upper lobes smaller than the 3 lower, velvety inside; stamens 4 fertile, 1 staminode about half as long as the fertile stamens; ovary conical, tapering into a slender style subequalling the stamens. Fruits indehiscent, greyish, sausage-shaped, hard and pendulous, up to 50cm long, 15cm in diameter, pedicels elongated; seeds numerous, unwinged, obovate, c.1.25cm long.

In Nigeria it is recorded as flowering from December to April and fruiting from June to August.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

There is no information available on modern medicinal and pharmaceutical uses of extracts from this plant. The only chemical constituent so far reported is tannin from the roots and stem bark (Oliver, 1959).

5. FOLK MEDICINAL USES

The fruits and roots of K. africana boiled along with the stem and tassel of a plantain are used medicinally as a cure for post parturition haemorrhage. A decoction of the stem bark of K. africana and the leaves of Irvingia gabonensis is used to cure spleen infection.

Powdered fruit of K. africana mixed with palm oil is a good remedy for dizziness. A decoction of leaves and stem bark for drinking and bathing serves as cure for malaria fever.

A decoction of the stem bark of K. africana, leaves of Cassia occidentalis and potash is used for curing gonorrhea and syphilis.

The bark is also used as a cure for rheumatism and dysentery (Oliver, 1959; Daziel, 1937) and a decoction of stem bark is used to regularise menstrual flow. Stem bark paste mixed with palm oil and salt is used for the treatment of a retained placenta.

To combat infertility, a mixture of ground K. africana young fruit and snails, rolled into balls and allowed to dry is eaten with a cup of tea every day.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

None recorded to date apart from tannin.

7. HARVESTING, CONSERVING AND PREPARATION

No details available other than those under (5).

8. ECONOMICS AND MARKETING

Locally collected for domestic purposes.

9. SILVICS

Regenerates naturally from seed.

10. MAJOR DISEASES

A rust disease, caused by Newinia kigeliae has been reported by Eboh (1983).

11. OTHER USES

Wood light, white, heartwood light brown.

A black dye can be produced from the fruit. In Uganda slices of baked fruit are used to flavour the local beer (Irvine, 1961). In Nigeria pieces of fruit soaked in water together with small pieces of metal and sprinkled with young palm fronds will stimulate the germination of yam tubers as well as promote a good harvest.

The fruit extract has been reported to have molluscicidal properties (Adewumi and Sofowora, 1980).

12. BIBLIOGRAPHY

Adewumi, C.O. and Sofowora, E.A. (1980) Preliminary screening of some plant extracts for molluscicidal activity. Planta Medica 39: 57-65.

Dalziel, J.M. (1937) The Useful Plants of West Tropical Africa. London: Crown Agents.

Eboh, D.O. (1983) A new species of Newinia from Nigeria. Mycologia 75,2: 316-318.

Eboh, D.O. (in press) Uredinales Nigerianensis IV. Mycologia.

Innamorati, T.F. (1971) Osservazioni morfo-ecologiche e sistematiche sul genere Kigelia DC. Webbia 25,2: 589-621.

Irvine, F.R. (1961) Woody plants of Ghana. London: Oxford University Press.

Oliver, B. (1959) Medicinal Plants in Nigeria. Ibadan: Nigeria College of Arts, Science and Technology.

Dale, J.R. and Greenway, P.J. (1961) "Kenya trees and shrubs" Government of Kenya and Hatchards. 187 Piccadilly,London W.I.

PLATE XVIII. Kigelia africana (Lam.) Benth.

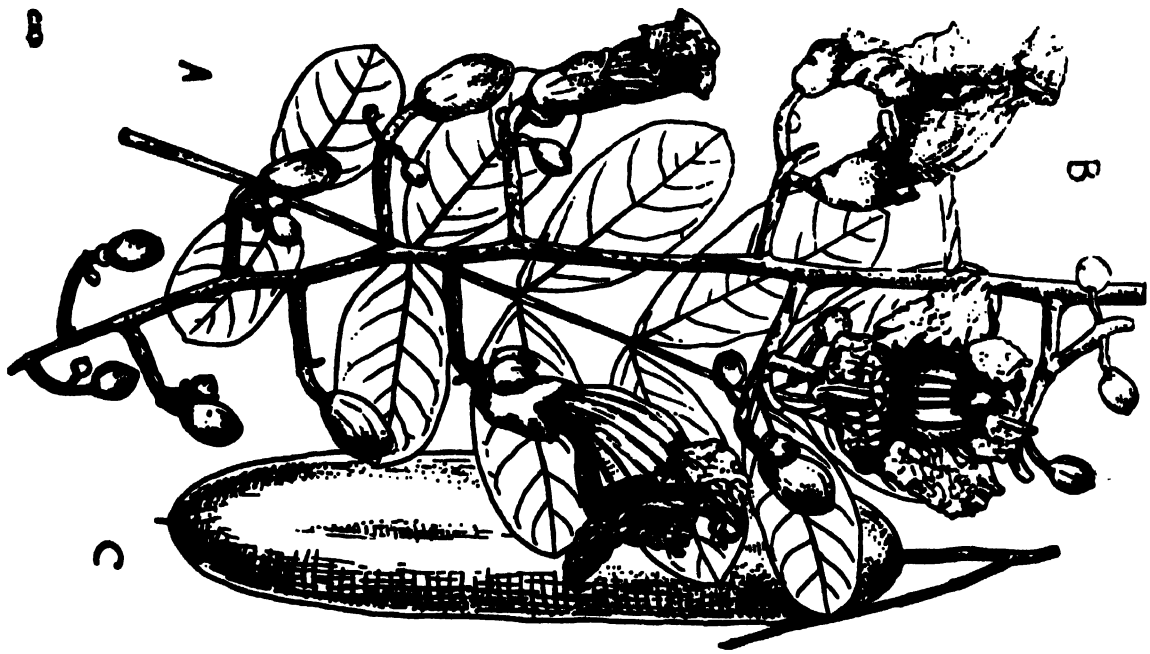


Plate XVIII. Kigelia africana (Lam.) Benth.

A. leaf B. inflorescence C. fruit (Source Keay et al., 1964)

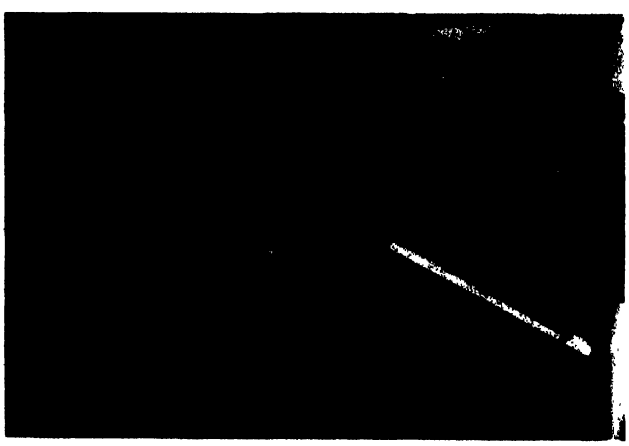
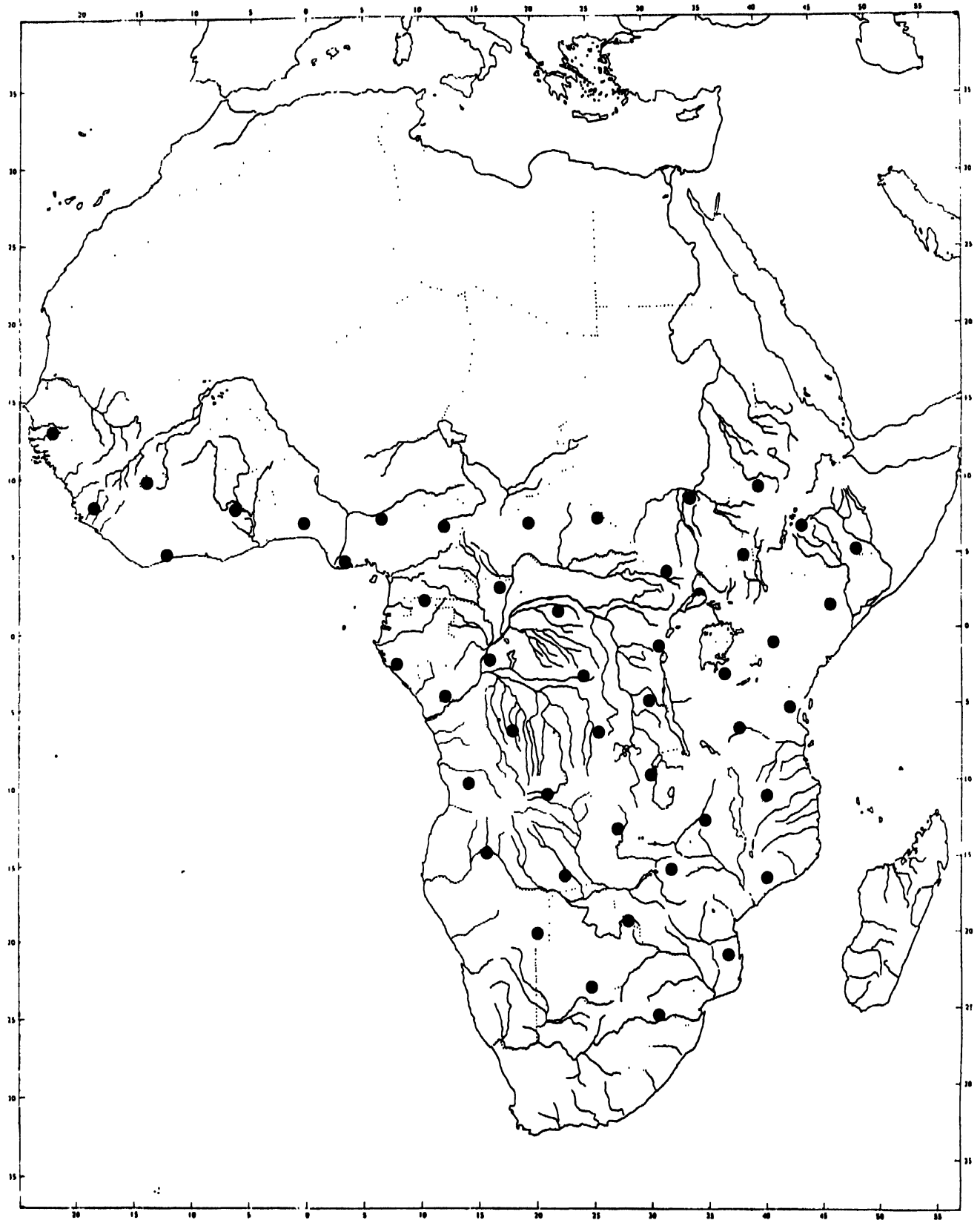


Plate XVIII-1 A fruit specimen of Kigelia africana

MAP 18 - Geographic distribution of Kigelia africana



1. BOTANICAL NAME: Lonchocarpus sericeus (Poir.) Kunth

FAMILY: Leguminosae Subfamily Papilionoideae

COMMON NAMES: Senegal lilac, Dukaw (Wassaw); Boma (Sefwi); Kwandwo-amanin, Ofefrae, Osantewa (TWI); Totoro (Ashanti); Ipapo (Yoruba); Njassi (Bo).

2. ECOLOGY AND DISTRIBUTION

Lonchocarpus sericeus occurs in coastal savanna woodlands; it is fairly common in fringe and transition forests, usually near water. In Ghana it is found throughout the high forest zone as well as in the Volta Region and in neighbouring Togo. It is sometimes used as a shade tree in gardens and cemetries. It regenerates freely from seeds.

Lonchocarpus is fairly tolerant of climatic and edaphic conditions and is able to withstand fairly long periods of drought provided soil conditions are favourable. It thrives at temperatures between 25° and 35° and with an annual rainfall of not less than 900mm. It is a lowland tree.

It is a West African species, native to Senegal, Gambia, Guinea Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Dahomey, Nigeria, Fernando Po and Cameroon. It has been introduced elsewhere in tropical Africa, also in tropical America and the West Indies, where it is reported to have naturalized (see distribution map).

3. DESCRIPTION

A tree 12-15m high, 1.2-1.4m in diameter; bark greyish, fairly smooth, slash yellowish-brown with reddish streaks; sometimes branching low-down; twigs and young shoots covered with brownish velvety hairs. Leaves imparipinnate with 3-5 pairs of opposite leaflets, stipules inconspicuous and soon falling; rachis 10-20cm long; leaflets increasing in size towards the terminal leaflet, ovate-elliptic or elliptic, 6-14cm long, 3-9cm wide, apex shortly or bluntly acuminate, base rounded to broadly cuneate or subcordate, margins entire or slightly wavy, glabrous above, pusbescent below, midrib prominent below, lateral nerves 6-10 pairs, upcurving, slightly compressed above, prominent below; petiolules 5-8mm long. Inflorescence in conspicuous axillary, pedulous racemes towards the end of shoots; pedicels usually paired, short, hairy. Flowers pale purple or lilac, calyx broadly cup-shaped, 5mm long, lobes obscure, densely hairy; standard petal suborbicular, 12-20mm long, densely silky outside; stamens about 12mm long, united into a tube. Fruits flattened indehiscent pods, clustered, persistent, 5-15cm long, about 1.5cm wide, irregularly constricted between the seeds and more or less twisted, both ends acute, margins thickened, the upper margin with a narrow crest but not winged, rusty pubescent, calyx remains persistent. Seeds oblong-kidney-shaped, reddish-brown, about 7mm long, 5mm wide.

Commonly flowering in the deciduous state when it is usually easily recognized by its showy pale purple or lilac, fragrant flowers. These may sometimes be mistaken for Millettia thonningii (Schum. & Thonn.) Bak., from which it may best be distinguished by the fruits, which are indehiscent in Lonchocarpus and dehiscent in Millettia.

The tree is deciduous during the dry season, which in Ghana is between December and February. The flowering periods are between December and February and April to July. Fruiting is from November to May with the pods hanging on the tree for a long time before falling.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

In Tropical America the tree is quoted as an insecticidal plant.

It appears Lonchocarpus sericeus has not been studied chemically in Ghana, but it is popularly known that most of the Lonchocarpus species, especially L. urucu in Brazil and L. utilis in Peru are a source of Rotenone, a compound which is used universally as an insecticide also present in L. sericeus (Oliver, 1960). The dried roots are powdered and mixed with clay for dusting or mixed with liquid for spraying.

5. FOLK MEDICINAL USES

In Nigeria the bark is often applied as a lotion in the treatment of convulsion and backache, while it is also applied in Ghana for parasitic skin conditions and eruptions. The bark is employed throughout the area of distribution as a stomachic and laxative for children.

In Ghana an infusion of the bark mixed with lime is applied as a bath for the cure of biliousness and fever in children. Part of the liquid is also administered orally in small doses for the same illness. (Traditional medicine).

According to Dalziel (1937), Lonchocarpus spp. are used as a medicine for horses.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Castagne (1946), isolated "lonchocarpine" from the plant. A yellowish-orange dye or resin occurs in the seeds and the fruit is considered to be a violent poison in Casamance (Aubreville, 1936).

A green dye can be obtained from the bark (Irvine, 1961). It has been used as a fish poison (Kerharo and Bouquet, 1950).

Lonchocarpus species have an extensive folklore in the Caribbean region as fish poison, almost certainly due to the presence of Rotenone. (Commonwealth Science Council)

Leaves and bark contain 2-6% rotenone (Oliver, 1960).

7. HARVESTING, CONSERVING AND PREPARATION

The bark is obtainable by slashing or peeling with a cutlass. The leaves and the fruits can be collected from the tree by climbing as it often branches low down. In Ghana medicinal plant materials are usually preserved by drying them in the sun and keeping them in paper bags or light wrappers. The plant parts are sometimes pounded into powder form. Extraction of medicinal properties is effected by boiling or steeping in water.

8. ECONOMICS AND MARKETING

The tree yields valuable timber. Although it is not one of the exploited species in Ghana at the moment, probably because of the size, it has a potential as a commercial wood. The insecticide in the plant may also be of potential value.

9. SILVICS

Lonchocarpus sericeus thrives on wet areas and along river banks. It regenerates itself satisfactorily on favourable sites and can be propagated by seeds. It has been grown as a shade tree in villages, gardens and cemetries but has not been cultivated in plantations in Ghana.

10. MAJOR DISEASES

None have been recorded.

11. OTHER USES

The heartwood is olive-green when freshly cut and is closely grained. It is recognised as strong, tough, durable and resistant to water. Though it is stringy and difficult to saw it takes on a good polish.

Chevalier (1913) suggests its use for automobile and railway vehicles and for ornamental pattern work. In Ghana it is used for building and for hoe handles. In Sierra Leone it is used in making boat-bands. The Krobo's in Ghana use the bark as fibre (Irvine, 1961).

It has been used as fish poison (Kerharo and Bouquet, 1950). The tree is very ornamental when in flower and has been planted for amenity purposes.

12. BIBLIOGRAPHY

Aubreville, A. (1936) — La flore forestière de la Côte d'Ivoire, 3 Vols. Paris, Larose.

Chevalier, A. (1913) — Etudes sur la flore de l'Afrique centrale français, Paris: Challemel édit.

Commonwealth Science Council — Report on the second Caribean meeting on utilisation of Natural Products

Castagne, E. (1946) — Contributions a l'étude chimique de quelques bois congolais. Publi. Insti. nat. Etude agron. Congo Belge No. 32.

Dalziel, J.M. (193) — The Useful Plants of West Tropical Africa. London: Crown Agents.

Irvine, F.R. (1961) — Woody Plants of Ghana. London:

Kerharo, J. and Bouquet, A. (1950) — Plantes médicinales et toxiques de la Côte d'Ivoire - Haute Volta, Paris - Vigot édit.

Oliver, B. (1960) — Medicinal Plants in Nigeria, Ibadan: Nigeria College of Arts, Science and Tech.

PLATE XIX. Lonchocarpus sericeus (Poir). Kunth

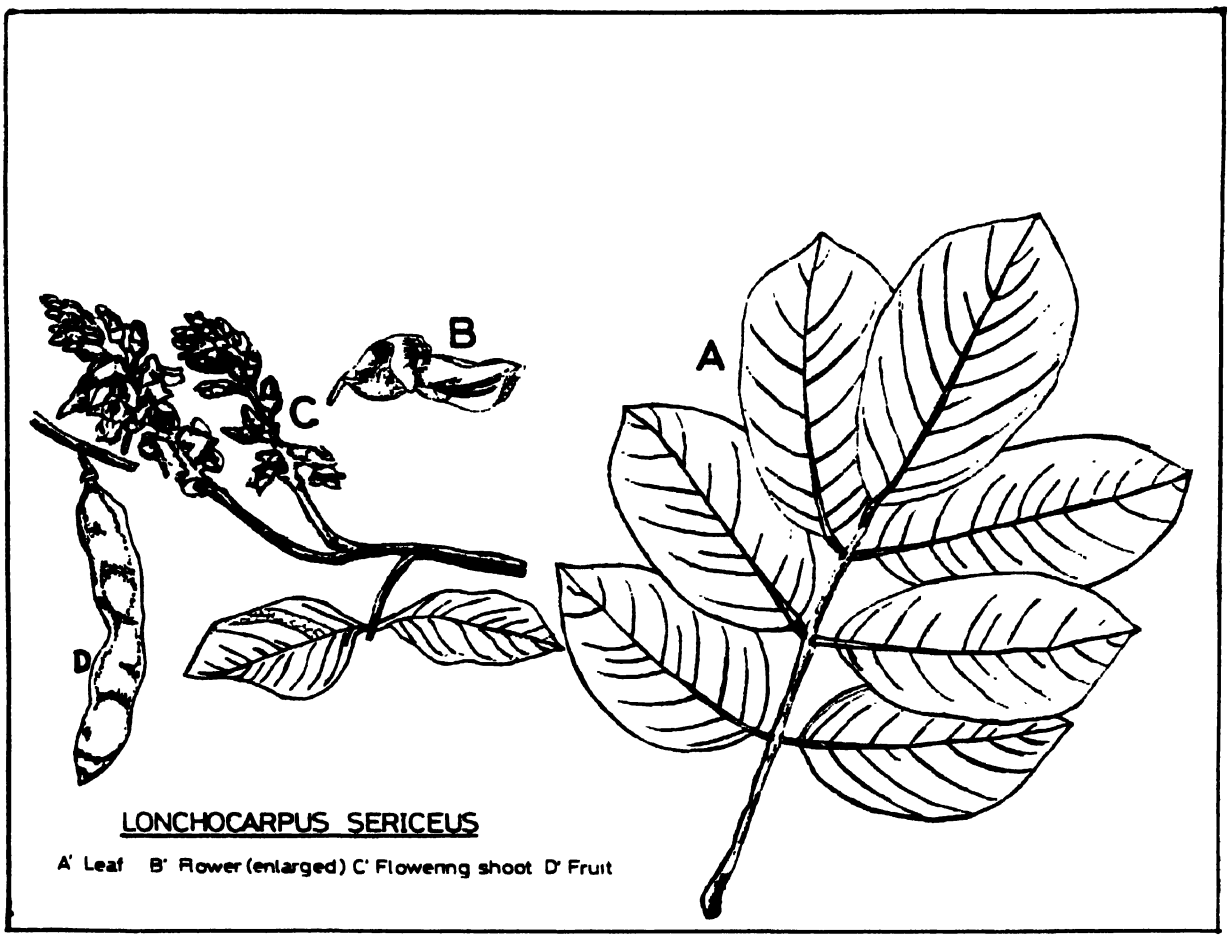


Plate XIX. Lonchocarpus sericeus (Poir.) Kunth

A. leaf

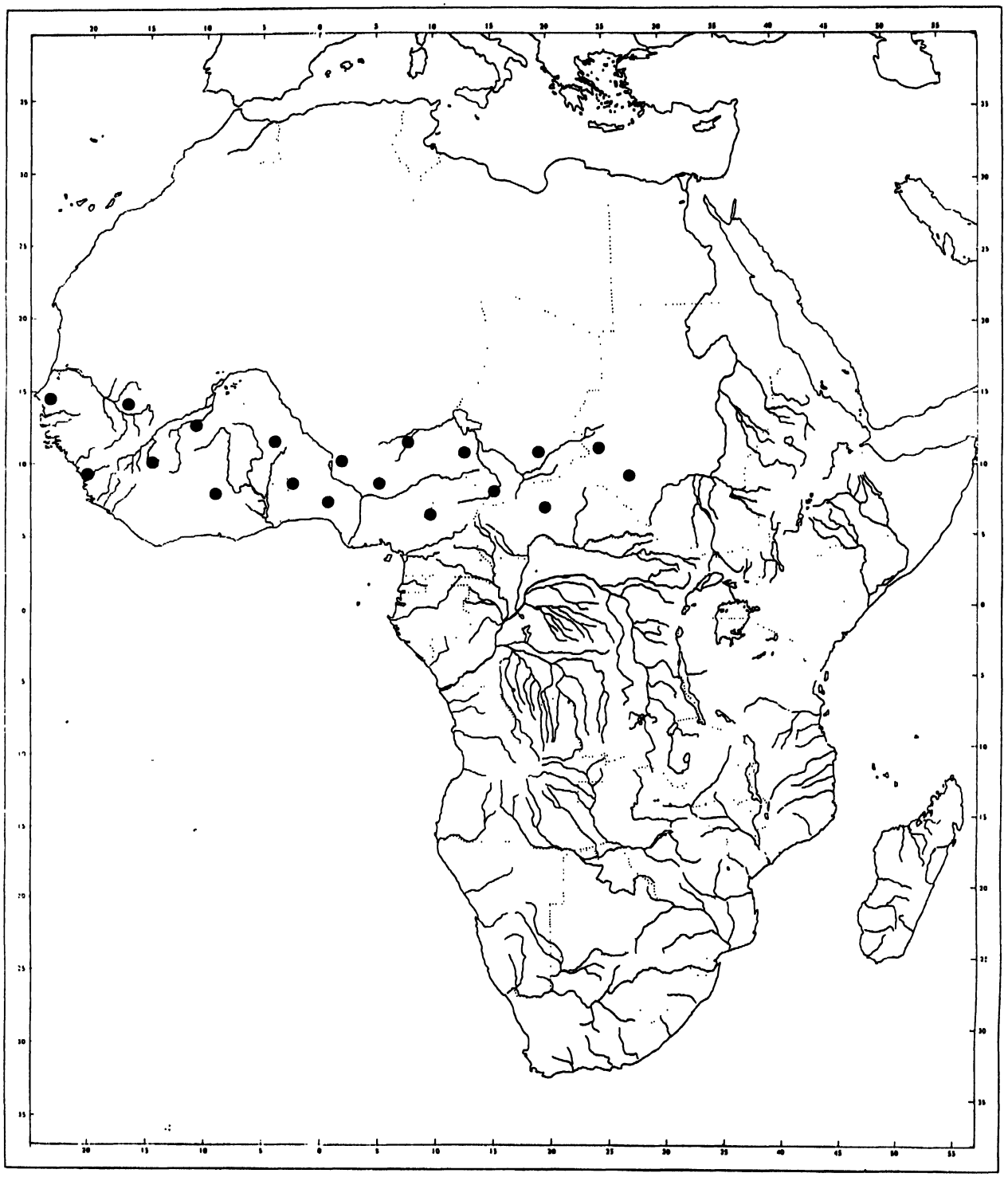
B. flower (enlarged)

C. flowering shoot

D. fruit

(B,C and D after Keay et al., 1960)

MAP 19 - Geographic distribution of Lonchocarpus sericeus



1. BOTANICAL NAME: Luehea paniculata Mart.

SYNONYM: Luehea parvifolia Huber

FAMILY: Tiliaceae

COMMON NAMES: Açoita-cavalo, Mutamba preta (Brasil, Pará); Estriveira, Cacueti, Caa-veti, Caa-Veti-guassu (Paraguay); Papeaguaçu, Ivá tingy (Guarani); Flintenklben (Germany); Francisco Alvarez (Argentina).

2. ECOLOGY AND DISTRIBUTION

Luehea paniculata occurs on the rich, fertile, mesotrophic soils of the deciduous forest or cerrado (transition from savanna to forest).

The species is found in the coastal states of Brasil (see distribution map).

3. DESCRIPTION

Medium to tall tree to c.10m high in the cerrado (Rizzini, 1971) and up to 13m in the deciduous forest (Ratter, 1980); bark thin, greyish-brown, longitudinally ridged, fibrous, periderm mucilaginous, sometimes astringent and bitter; crown spreading, leafy. Leaves alternate, simple; stipules 4-5mm long, soon falling; petiole 5-7mm long; blade broadly oval, oval-elliptic or oval, asymetric, 7-12cm long, 4.5-7cm wide, apex shortly acuminate, base truncate to subcordate, margins dentate, coriaceous, glabrous, green and rough above, ferruginous tomentose below, 3-nerved from the base. Inflorescence a terminal or axillary paniculate cymes, flowers conspicuous, fragrant, melliferous; peduncle and pedicels 5-10mm long, multibracteate. Sepals 5, lanceolate, 11-12mm long; petals 5, obovate, c.16mm long, 13mm wide, irregularly crenate, with basal nectiferous gland; stamens in 3-4 bundles of 20-24, 4-7mm long; ovary 5-locular, ovules numerous, ovange tomentose. Fruit a woody, valvate, oblong capsule c.2cm long, 1.2-1.4cm in diameter, slightly angular, densely reddish tomentose; seeds with thickened edges, caruncle forming an apical appendix.

Flowering is from February to June, depending upon the region and fruiting from August to October.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None identified.

5. FOLK MEDICINAL USES

A decoction of the bark and periderm is used as a treatment for cramps, leucorrhea, tumors, ulcers, gangrenous wounds and haemorrhages. 20 grams of grated bark and periderm are boiled for 5 minutes in a litre of water. The decoction is applied externally. A similar decoction using 2 litres instead of 1 is taken internally 3 times a day as a treatment for liver complaints, fever, dysentery, rheumatism and ulcers. 20 grams of grated bark and periderm preserved in 60% alcohol for 30 days is taken internally in small quantities twice a day for the same complaints.

A decoction of the root is taken internally as a depurative for the blood. A decoction of the leaves is taken internally to treat fever and diarrhoea, while the same decoction is used externally for haemorrhages, tumors and blenorrhea.

The white honey derived from the flowers is used as a stomach tonic.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Not analyzed to date but the presence of tannin is indicated (see 11) in the periderm.

7. HARVESTING, CONSERVING AND PREPARATION

No information available.

8. ECONOMICS AND MARKETING

The species' greatest importance is its utilization in the textile and timber industry.

Wood characteristics: yellowish-white wood, uniformly flexible, presenting a rose tonality, moderately heavy and hard, very susceptible to the action of deleterious agents. Elastic and resistant wood, with a specific weight between 0.530 and 0,586.

9. SILVICS

No information available.

10. MAJOR DISEASES

No information available.

11. OTHER USES

The Genus produces good-looking wood, used in the making of artistic objects, butts of firearms, airplane propellers, pianos, construction beams, chairs, brushes, saddles and shoe moulds.

The fibres of the cortex are utilized in the making of cords and braids.

The tannin found in the periderm (Inner bark) is employed in the tanning of leather.

The name "horse whip" (açoita-cavalo) derived because of the straight and flexible branches, which are used as rustic horse whips.

It is popular belief that the whole family is considered sacred and ropes are made from the fibres of the cortex, serving as amulets which protect one from witchcraft.

Hoehne (1978), considers the family harmful to those animals which eat its leaves or fruits, however some types of large leaves may be considered as forage.

12. BIBLIOGRAPHY

Hoehne, F.C. (1978) Plantas e Substâncias Vegetais Tóxicas e Medicinais. Departamento de Botânico do Estado de S. Paulo. Ed. Novos Horizontes, Sao Paulo. 355 p.

PLATE XX. Luehea paniculata Mart

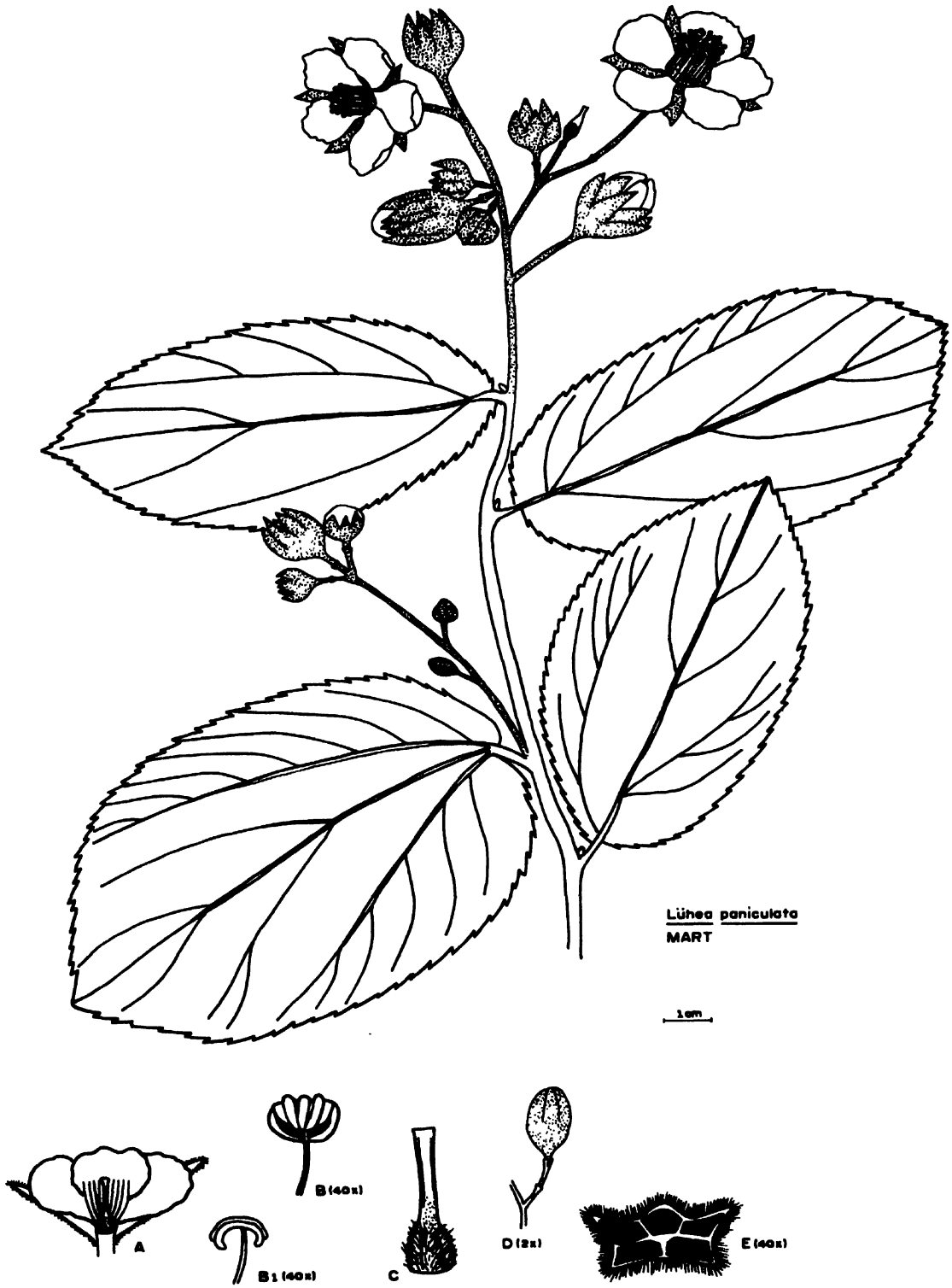


Plate XX. Luehea paniculata Mart.

(a) cross section of flower (b) detail of anther (c) gynoecium (d) floral bud (e) cross section of ovary

(From Ratter, J.A. et al exsiccate 930 and 151 UB)

MAP 20 - Geographic distribution of Luehea paniculata

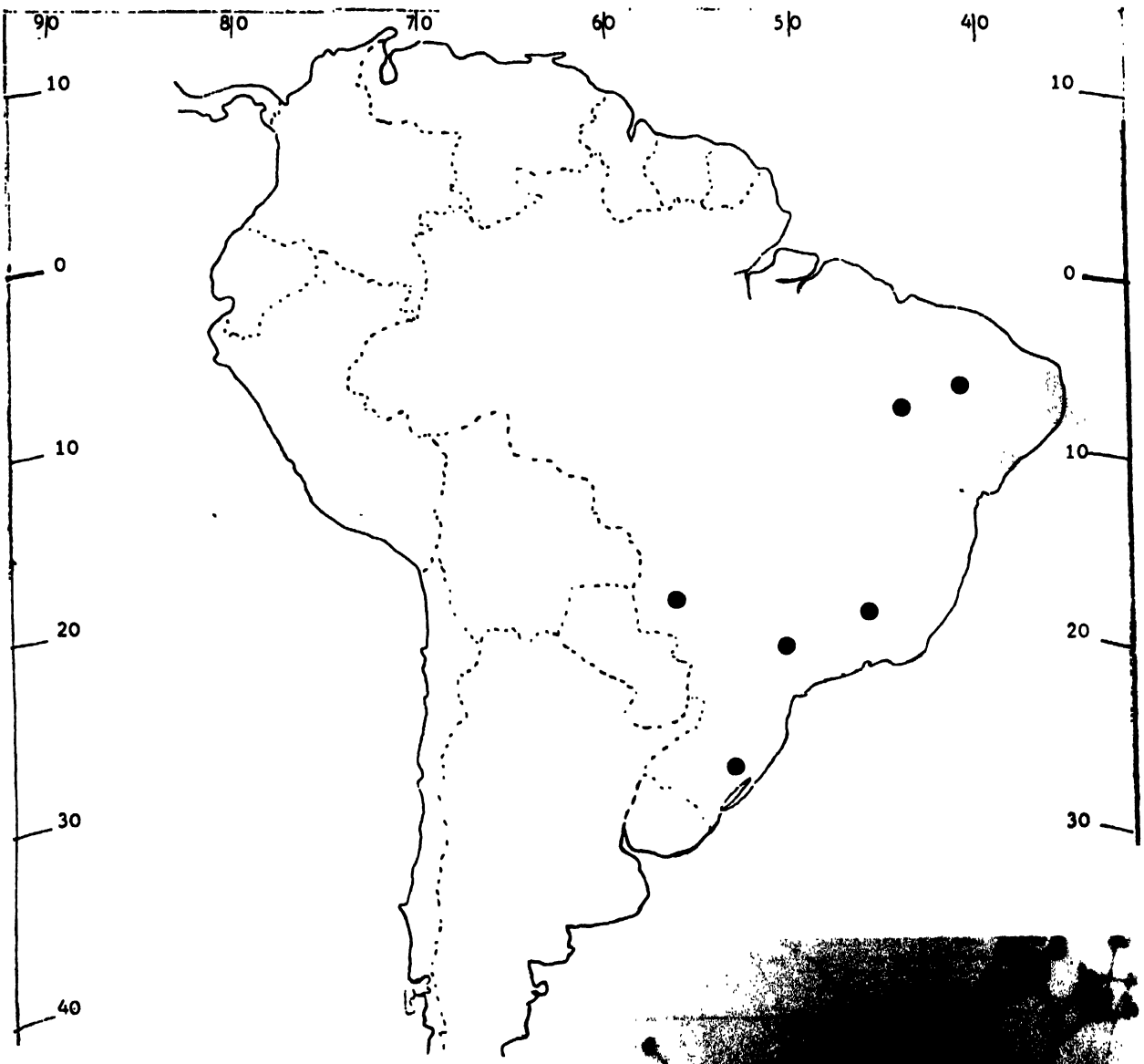


Plate XX-1

Herbarium specimen
University of Brasilia

1. BOTANICAL NAME: Maytenus buchananii (Loes.) Wilczek

SYNONYMS: Gymnosporia buchananii Loes.
Maytenus ovata (Walp.) Loes. var. ovata forma pubescens Blakelock partly

FAMILY: Celastraceae

COMMON NAMES: Mudziadzyah (Digo, Kenya), Umutukuza, Urutka (Rwanda), Mukululubishia (Katenga), Mutumbwishia (Zambia), Musoma (Kindembo, Zaire), Umushubi (Musaka, Zaire), Mubamba ngoma, Mumpulukuswa, Pulukusva (Kitabwa, Zaire), Musonga, Sombo (Kiluba, Zaire), Umasakara, Umutukaza (Kinyaruanda, Zaire)

2. ECOLOGY AND DISTRIBUTION

An understorey, light demanding tree of open lowland, montane and riverine forests and forest margins, also high rainfall savanna woodlands. It occurs on a wide range of soils including sandy,larval and limestone soils; acid soils preferred. Altitudinal distribution ranges between 15 and 2400m, but according to herbarium records the main distribution lies between 1100 and 1500m.

In the absence of any published information the climatic parameters have been obtained by comparing the distribution of the species with the climatic diagrams of Walter & Lieth (1969). The inferred rainfall is 850-2000 (-3000)mm per annum with a short dry season. The mean annual temperatures are 19-28°C. It is inferred that Maytenus buchananii is unlikely to be frost tolerant.

The species is widely distributed in tropical Africa being recorded from Ivory Coast, Nigeria, Cameroon, Gabon, Fernando Po, Central African Republic, Zaire, Rwanda, burundi, S. Sudan, S. Ethiopia, Uganda, Kenya, Tanzania, Malawi, Mozambique, Zambia Angola (see distribution map).

3. DESCRIPTION

Shrub or small evergreen tree 2-12m high, sometimes more or less scandent, with paired spines up to 2.8mm long; inner bark of large stems red with a thin, bright yellow layer just under the outer grey surface; small stems pink slash without yellow layer and can be confused with Flacourtia spp.; branches more or less flattened and angular, brown to grey, puberulous when young. Leaves spirally arranged, simple, petiolate; petiole 2-9mm long, pale when green to wine red; lamina elliptic or elliptic-oblong to ovate, oblanceolate or suborbicular, 1-1.7cm long, 0.8-8cm wide, apex obtuse to rounded or rarely acute to shortly acuminate, especially when young, base attenuate to cuneate, rarely rounded, margins shallowly crenulate-serrulate, glabrous, coriaceous, pale to yellowish- or mid-green, sometimes paler below, lateral nerves and dense reticulate venation more prominent below than above. Inflorescence of solitary, axillary, dichasial or monochasial cymes, 0.5-2.3cm long; whitish puberulous; pedicels 2-5mm long, puberulous, articulated in the lower half; flowers 3-25 per cyme, about 2.5mm in diameter, polygamous, 5-merous. Sepals lanceolate to triangular, 0.5-1.25mm long, apex acute to subacute, margins ciliolate; petals white to cream, oblong, 1.5-2.5mm long, margins ciliolate to more or less entire; stamens 5, exceeding to slightly shorter than petals, filaments 1-3mm long, slender, arising from below the disk; disk narrow, convex, not

lobed, about 1.25-1.5mm in diameter; ovary ovoid, 3-locular, about one quarter immersed in disk, style up to 0.75mm long, 3-fid at apex. Fruit a pink or red capsule, obconic, 4-10mm long, 3-sided, truncate or lobes slightly ascending, coriaceous, smooth. Seeds (2-)3, red, turning brown, glossy with fleshy white to pale yellow aril at base. (Robson, 1966; Sesebe Demissew, 1983).

Flowering during the first half of the rains, fruiting in the latter half.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Maytansine has been isolated from the stem wood of Kenyan M. buchananii (Sneden & Beemsterboer, 1980). The compound has been extensively studied as part of the drug development programme of the Division of Cancer Treatment, National Cancer Institute in Bethseda, USA (Dorr & Fritz, 1980), in the course of which as much as 15,000kg of the stem wood was collected in 1976 (Sneden & Beemsterber, 1980). The drug has now reached phase II clinical trials (Cassady et al., 1981) despite earlier indications of marked toxicity (Chabner et al., 1978). Considerable activity has been directed towards it synthesis (Meyers & Shaw, 1974; Meyers et al., 1975; Meyers & Brinkmeyer, 1975; Corey & Bock, 1975; Elliott & Fried, 1976).

Maytansine has shown significant activity against various animal tumours, including B-16 melanoma, lymphatic leukaemia, and carsinosarcoma. Cytotoxic activity appears to be caused by inhibition of the proper formation of the mitotic spindle and thus cessation of cell division (Remillard et al., 1975). Side effects noted in phase I human studies were mainly gastro-intestinal, hepatic, and neurological. Nausea, vomiting, diarrhoea, and lethargy have been reported as being dose-limiting (Chabner et. al., 1978).

Structure/activity-relationship studies have shown that the C-3 ester group is essential for in vivo activity (Kupchan et al., 1974, 1975).

5. FOLK MEDICINAL USES

Roots of the related Maytenus senegalensis (Lam.) Exell (the Confetti tree) chipped into beer have been used in Zambia as an aphrodisiac (Lewis & Elvin-Lewis, 1977). The roots, which are slightly bitter, are also mildly laxative and are used in various parts of tropical Africa for gastro-intestinal troubles, especially dysentery (Irvine, 1961), and a poultice of the green leaves has been put on sores in Tanzania (Altschul & Lipp, 1982). M. thompsonii (Merrill) Fosberg has been employed medicinally in the Mariana Islands (Altschul & LIpp, 1982).

In Brazil leaves of M. ilicifolia Reiss. have been used as a wash for cutaneous cancers (Hartwell, 1968) and in Paraguay extracts of the plant have been used for birth control purposes (Gonzalez Gonzalez et al., 1982). The bark of unidentified Maytenus species has been used against syphilis in Brazil (Altschul & Lipp, 1982). Leaves of M. pseudocasearia Reiss. are used for dysentery in Brazil (Altschul, 1973). Various bark extracts of M. laevis Reiss. have been used in Colombia as an anti-arthritic (Gonzalez Gonzalez et al., 1982). Aqueous extracts of the stems, leaves, and seeds of M. boaria find use in Central Chile for treating internal pain (San Martin., 1983).

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

In addition to maytansine, M. buchananii contains the related compounds maytanprine and maytanbutine (Kupchan et al., 1972b), and normaytansine (Sneden & Beemsterboer, 1980). Maytansine, maytanprine, and maytanbutine have also been isolated from M. graciliramula S.J.Pei and Y.H.Li collected in Yunnan (Li et al., 1981) and maytansine is also present in the leaves of M. confertiflora J.Y.Luo and X.X.Chen (Wang et al., 1981a) and, together with maytanprine, in the stems of the same species (Wang et al., 1977a).

Apart from the sperimidine-type alkaloids celacinnine and celallocinine (Kupchan et al., and the nicotinoyl sesquiterpene alkaloids maytoline, maytolidine (Kupchan et al., 1977b; review: Smith, 1977) obtained from fruits of M. serrata (Hochst. ex A. Rich.) Wilczek collected in Ethiopia, the chief secondary chemical constituents in Maytenus species are the group of closely related ansa macrolide antibiotics whose major representative is the maytansine, $C_{34}H_{46}ClN_3O_{10}$, mentioned above and originally isolated by Kupchan et al. (1972a) from the fruits of M. ovatus (sic) (= M. serrata (Hochst. ex A. Rich.) Wilczek. The species M. serrata is a poor producer of seeds and those of M. buchananii may in fact be an improved source (Cordell, 1977).

A higher yield of maytansine is reported (Kupchan et al., 1977c) from the stem of related Putterlickia verrucosa Szyszyl. collected in South Africa; they contain 12.3mg maytansine/kg. This shrubby plant is apparently easily cultivated in the USA and may be a better commercial source of the compound (Trease & Evans, 1978).

Other substances isolated include various anti-tumour phenoldienone triterpenes from several species (via Gonzalez Gonzalez et al., 1982). M. laevis has yielded, in addition to the phenoldienones, a catechin and some pro-anthocyanidins (Gonzalez Gonzalez et al., 1982).

7. HARVESTING, CONSERVING AND PREPARATION

Maytansine is obtained from the woody stems of Maytenus buchananii. The method used by the United States Department of Agriculture Medical Plant Resources Laboratory for their initial screening of material collected in the Shimba Hills, near Mombasa, Kenya, was to mechanically chip the stems and then transport the material to a semi-desert region for sun drying before shipment to the United States for processing. There was approximately 40-43% loss of moisture on drying (Perdue, no date).

8. ECONOMICS AND MARKETING

Maytansine was first isolated from the seeds of a Maytenus species from Ethiopia. The species has been variously reported as M. serrata (Hochst. ex A. Rich.) Wilczek, M. arbutifolia (Hochst. ex A. Rich.) Wilczek and M. ovata (Wall ex Wight & Arn.) Loes., an Indian species (Spjut. & Perdue, 1976, Perdue, 1976). This uncertainty well illustrates the necessity of providing an identifiable voucher specimen when undertaking a scientific study. The location of the voucher must be officially recorded. The yield of maytansine was only 0.2mg/kg and it was considered doubtful if sufficient fruit would be available to meet the demand.

An improved source was found in the stems of M. buchananii from Kenya with a yield of 1.5mg/kg (Perdue, 1976a). More recent findings suggest that the same source from Tanzania is superior in yield. However, even higher yields of maytansine can be obtained from another member of the Celastraceae, Putterlickia verrucosa (E.Mey. ex Sond.) Szyszyl. from South Africa (Perdue, 1976b,). Although stems contain 12.3mg/kg of maytansine, the species was reported to be too widely scattered for economic harvesting unless grown under cultivation (Perdue, 1976a, Kupchan et al., 1977c). It is apparently easily cultivated in the USA and may prove to be a be better commercial source of the compound. (Trease & Evans, 1978).

The long term future of the Celastraceae, particularly Maytenus buchananii as a source of maytansine must be carelly assessed following the discovery by a research group in Japan that the microsporum Nocardia sp. is a more efficient producer of maytansinoids (Komoda & Kishi, 1980).

9. SILVICS

The major source of supply of maytansine has been M. buchananii in the Shimba Hills of Kenya. There has been no evidence of regeneration from coppicing following the initial harvesting in 1972, presumably because the plants are easily broken off at ground level and relatively few stems were left. Cutting stems well above ground level to encourage coppicing was attempted in 1976, no reports to date on the results. Natural regeneration from seed seems probable (Perdue, 1976a).

Vegetative reproduction by cuttings is practicable. The young plants produced viable seed within a year under greenhouse conditions near Washington, DC. (Perdue, 1976a). Field trials in Kenya suggested that plants propagated from seeds did better than plants from cuttings.

Interplanting with shade trees such as Prosopis spp. or Leucaena leucocephala are beneficial, resulting in better growth and earlier maturity (Haller, 1978).

10. MAJOR DISEASES

No problems evident as yet. Some insect damage reported, but can be controlled (Perdue, 1976a).

11. OTHER USES

The fruits of M. senegalensis are eaten in Botswana and the yellow-white wood, being hard and durable and with a fine grain, is used for walking sticks (Irvine, 1961). In Lesotho, the wood of M. acuminata (L.f.)Loes., M. heterophylla (Ecklon & Zeyher) N. Robson, M. undata (Thunb.)Blakelock (and other species is used for building and as firewood and fighting sticks (Jacot Guillarmod, 1971) and that of M. senegalensis (Lam.) Exell is an important boxwood in Malawi (Williamson, 1975). In dry areas of Sudan, M. senegalensis is browsed by goats and camels, and in Tanzania stock eat the leaves (Irvine, 1961). Leaves of M. boaria Mol. and M. viscifolia are eaten by livestock in Argentina (Altschul,1973).

12. BIBLIOGRAPHY

Altschul, S. Von Reis (1973) — Drugs and foods from little-known plants, Cambridge, Mass.; Harvard University Press, p 174.

Altschul, S. Von Reis and Lipp, F.J. (1982) — New plant sources from drugs and foods from the New York Botanical Garden Herbarium, Cambridge, Mass.; Harvard University Press, 166.

Cassady, J.M., Chang, C.J. and McLaughlin, J.L. (1981) — Recent advances in the isolation and structural elucidation of antineoplastic agents from higher plants, in Natural products as medicinal agents (J.L. Beal & E. Reinhard, eds.), Stuttgart; Hippokrates, 93-124.

Chabner, B.A., Levine, A.S., Johnson, B.L. and Young, R.C. (1978) — Initial clinical trials of maytansine, an antitumour plant alkaloid. Cancer Treat. Rep. 62, 429-433.

Cordell, G.A. (1977) — Recent experimental and clinical data concerning antitumour and cytoxic agents from plants, in: New natural products and plant drugs with pharmacological, biological or therapeutical activity. (H. Wagner & P. Wolff, eds.), Berlin, Heidelberg, and New York; Springer, 54-81.

Corey, C.J. and Bock, M.G. (1975) — Stereocontrolled route to a key intermediate for the synthesis of maytansine. Tetrahedron Lett. 1975, 1643-2646.

Dorr, R.T. and Fritz, W.L. (1980) — Cancer chemotherapy Handbook, London, Henry Kimpton, 493-497.

Elliott, W.J. and Fried, J. (1975) — Maytansinoids. Synthesis of a fragment of known absolute configuration involving chiral centres C-6 and C-7. J. Org. Chem. 41: 2469-2475.

Gonzalez Gonzalez, J., Monache, G. delle, Monache, F. delle and Marini-Bettolo, G.B. (1982) — Chuchuhuacha - a drug used in folk medicine in the Amazonian and Andean areas. A chemical study of Maytenus laevis, J. Ethnopharmacology, 5: 73-77.

Guillarmod, A.J. Jacot (1971) — Flora of Lesotho (Basutoland), Lehre, J. Cramer, 440.

Haller, R.D. (1978) — Progress report on Maytenus buchananii propagation and trial field planting at Bamburi Mombassa, Kenya. Baobab Farm Ltd. 3 pages mimeo.

Hartwell, J.L. (1968) — Plants used against cancer. A survey. Lloydia, 31: 71-170.

Irvine, F.R. (1961) — Woody plants of Ghana, London: Oxford University Press, 456-458.

Komoda, Y. and Kishi, T. (1980) Maytansinoids in J.M. Cassady & J.D. Douros (eds.) Antitumour Agents based on Natural Product Models: 353-389. New York: Academic Press.

Kupchan, S.M., Komoda, Y., Court, W.A., Thomas, G.J., Smith, R.M., Karim, A., Gilmore C.J., Haltiwanger, R.C. and Bryan, F.F. (1972a) Maytansine, a novel antileukemic ansa macrolide from M. ovatus. J. Amer. Chem. Soc. 94, 1354-1356.

Kupchan, S.M., Komoda, Y., Thomas, G.J. and Hintz, H.J. (1972b) Maytanprine and maytanbutine new antileukemic ansa macrolides from M. buchananii. J. Chem. Soc., Chem. Commun., 1972, 1065.

Kupchan, S.M., Komoda, Y., Branfman, A.F., Dailey, R.G. and Zimmerly, V.A. (1974) Novel maytansinoids. Structural inter-relations and requirements for antileukemic activity. J. Amer. Chem. Soc. 96, 3706-3708.

Kupchan, S.M., Branfman, A.R., Sneden, A.T., Verma, A.K., Dailey, R.G., Komoda, Y. and Nagao, Y. (1975) Novel maytansinoids. Naturally occurring and synthetic antileukemic esters and maytansinol. J. Amer. Chem. Soc. 97, 5294-5295.

Kupchan, S.M., Hintz, H.P.J., Smith, R.M., Karim, A., Cass, M.C., Court, W.A. and Yatagai, M. (1977a) Macrocyclic spermidine alkaloids from Maytenus serrata and Tripterygium wilfordii. J. Org. Chem. 42, 3360-3664.

Kupchan, S.M. and Smith, R.M. (1977b) Maytoline, maytine and maytolidine, novel nicotinoyl sesquiterpene alkaloids from Maytenus serrata (Hochst., ex A. Rich.) R. Wilczek. J. Org. Chem. 42, 115-118.

Kupchan, S.M., Komoda, Y., Branfman, A.R., Sneden, A.T., Court, W.A., Thomas, G.J., Hintz, H.P.J., Smith, R.M., Karim, A., Howie, G.A., Verma, A.K., Nagao, Y., Dailey, R.G., Zimmerly, V.A. and Sumner, W.C. (1977c) The maytansinoids. Isolation, structural elucidation and chemical inter-relation of novel ansa macrolides. J. Org. Chem., 42, 2349-2357.

Lewis, W.H. and Elvin-Lewis, M.P.F. (1977) Medical Botany. New York, London, Sydney, Toronto: Wiley Interscience, 329.

Li, C.M., Li, B.J., Wang, C., Zhou, Y.L. and Huang, L.Y. (1981) Characterisation of three anticancer principles form Maytenus graciliramula S.J. Pei and Y.H. Li. Acta Pharm. Sinica, 16: 635-637.

Meyers, A.I. and Shaw, C.C. (1974) Studies directed toward the total synthesis of maytansine. The preparation and properties of the carbinolamine moiety. Tetrahedron Lett. 1974, 717-720.

Meyers, A.I. and Brinkmeyer, R.S. (1975) Progress toward the total synthesis of maytansine. A model system containing the C-7 and C-16 moiety (southern and eastern zone). Tetrahedron Lett. 1975, 1749-1752.

Meyers, A.I., Horne, D.,Shaw, C.C., Trefonas, L.M. and Majeste, R.J. (1975) Progress toward the total synthesis of maytansine. A stereoselective synthesis of the C-1 to C-7 moiety (northern zone). Tetrahedron Lett. 1975, 1745-1748.

Perdue, R.E. (1976a) Maytansine and Maytenus buchananii: current status and prospects for the future. USDA, Agricultural Research Center, Beltsville. 6 pages, 29 Oct., 1976, mimeo.

Perdue, R.E. (1976b) Procurement of Plant Materials for Antitumour Screening Cancer Treatment Reports 60,8: 987-998.

Perdue, R.E. (no date) About Maytenus buchananii (Maytenus ovatus) and the anti-cancer agent, "maytansine". US Dept. Agric. Medical Plant Resources Laboratory, Beltsville. 3 pages mimeo.

Remillard, R.N., Rebhun, L.I., Howie, G.A. and Kupchan, S.M. (1975) Antimitotic activity of the potent tumor inhibitor maytansine, Science 189: 1002-1005.

Robson, N.K.B. (1966) Celastraceae in Flora Zambesiaca 2,2: 355-418.

San Martin A. José (1983) Medicinal plants in Central Chile. Econ. Bot. 37: 216-227, 219.

Sebsebe Demissew (1983) Maytenus. ms.

Smith, R.M. (1977) The Celastraceae alkaloids, in: The Alkaloids (R.F.H. Manske, ed.), New York, San Francisco, London, Academic Press, London, vol. 16, 215.

Sneden, A.T. and Beemsterboer G.L. (1980) Normaytansine, a new antileukemic ansa macrolide from Maytenus buchananii. J. Nat. Prod. 43: 637-640.

Spjut, R.W. and Perdue, R.E. Jr. (1976) Plant Folklore: a tool for predicting sources of antitumor activity. Cancer Treatment Reports, 60, 8: 979-985.

Trease, G.E. and Evans, W.C. (1978) Pharmacognosy, 11th ed., London: Baillière Tindall, 624.

Walter, H. and Lieth, H. (1969) Klimadiagramm Weltatlas. Jena: Fischer.

Wang, X.F., Wei, R.F., Chen, J.Y. and Jiang, D.Q. (1981a) Studies on the antitumor constitutent of Maytenus confertiflora J Y Luo and X. X. Chen Acta Pharm. Sinica 16: 59-61.

Wang, X.F., Chen, J.Y., Wi, R.F. and Jiang, D.Q. (1981b) Studies on the antitumor constitutents of Maytenus confertiflora Luo et Chen (Celastraceae). Acta Pharm. Sinica 16: 628-630.

Williamson, J. (1975) Useful plants of Malawi, University of Malawi, 160.

PLATE XXI. Maytenus buchananii (Loes.) Wilczek

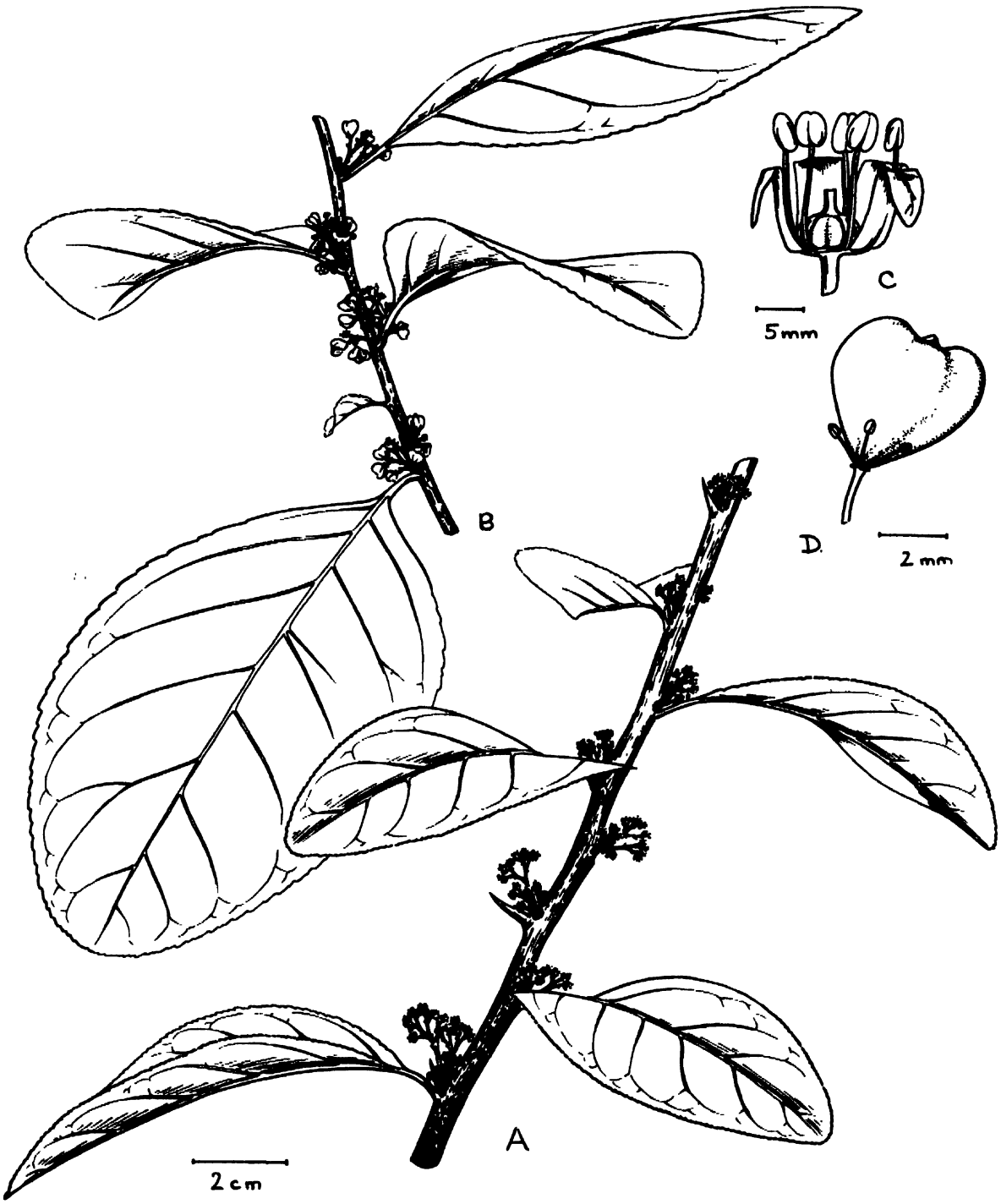
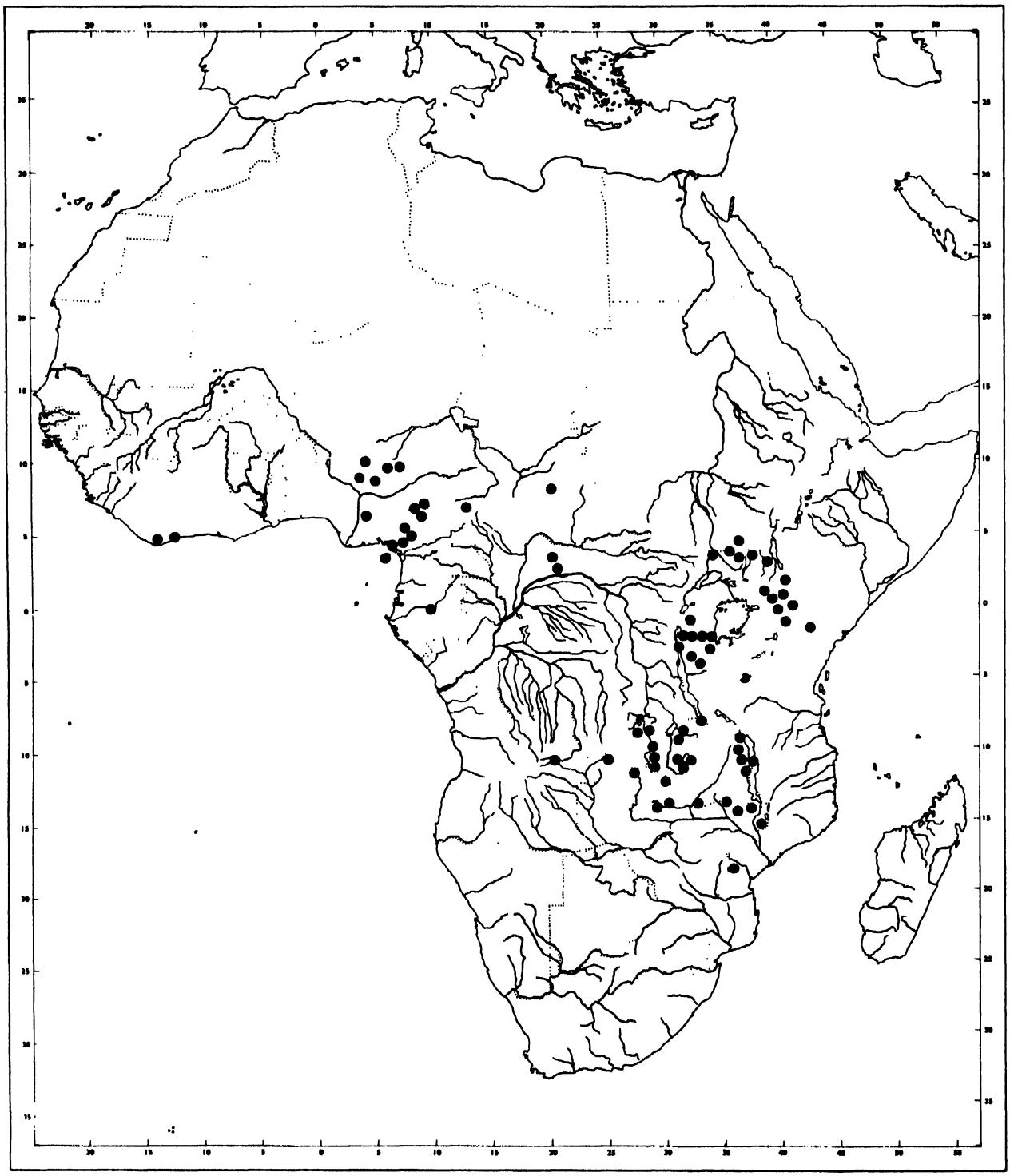


Plate XXI. Maytenus buchananii (Loes.) Wilczek

		Bar scale
A.	Flowering branch	2 cm
B.	Fruiting branch	2 cm
C.	Flower	5 mm
D.	Fruit	2 mm

MAP 21 - Geographic distribution of Maytenus buchananii



1. BOTANICAL NAME: Mitragyna ledermannii (K. Krause) Ridsd.

SYNONYMS: Adina ledermannii K. Krause
Mitragyna ciliata Aubrév. & Pellgr.

FAMILY: Rubiaceae

COMMON NAMES: Abura (Oruba), Uburu (Ibo), Eben (Bini), Uwen (Afik), Subaha (Wassaw, Twi), Baya (Mzima).

2. ECOLOGY AND DISTRIBUTION

Mitragyna ledermannii is a characteristic tree of fresh water swamps where it is often gregarious, also common in narrow fringing belts along streams in high forest areas, grass plains and in low lying swampy areas of deciduous and evergreen rain forests. It has been found in swampy areas at high altitudes e.g. at 500m at Udi Plateau in Nigeria and at 600m at Vane in Ghana. It is also present along riverine forests within the savanna. Quite often it is in pure communities with associates such as Gilbertiodendron, Randia lane-poolei, Symphonia globulifera and Raphia vinifera. It has been observed to regenerate freely on abandoned rice farms. It is a light demander. Growth is rapid and an annual height of 0.6 to 1m is not uncommon. Propagation also occurs vegetatively.

Fresh water conditions are essential for its regeneration and subsequent growth. It grows best in humid areas where the rainfall is over 1250mm per annum and the temperature between 25°C and 35°C although it will also grow in fresh water swamps outside these ranges. It does not cause swamps to dry up.

It occurs in the coastal regions of West Africa, in Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Gabon, Equatorial Guinea, Zaire, Congo Republic and Angola (see distribution map).

3. DESCRIPTION

A medium to large evergreen tree 24-30(-45)m high, 0.7-0.9(-1.2)m in diameter, rarely buttressed, root spurs up to 1m high sometimes present, occasionally pneumatophores; bark greyish brown with flat, thin scales; slash cream-yellow with pinkish under layer which turns brown on exposure, thick and fibrous; bole straight, cylindrical and clear of branches for up to 21m or more; crown small, compact, irregular. Leaves large, simple, opposite, petiolate with large, conspicuous inter-petiolate stipules; petiole 1.5-4cm long, stipules ovate-elliptic to obovate, 4-10cm long, 3-7cm wide, tomentose; blade broadly elliptic to suborbicular, 10-65cm long, 8-44cm wide, apex rounded or obtuse, base truncate to cuneate, margins slightly undulate, medium green above, paler below, glabrous except for tuft of hairs in the leaf axils; midrib and 7-12 pairs of lateral nerves prominent below. Inflorescence axillary or terminal, lax cymes of dense globose flower heads up to 2cm in diameter borne on pedicels 2-7cm long; flowers white, hermaphrodite, 5-7 merous, each flower surrounded by up to about 15 wedge-shaped bracts about 4mm long, bracts ciliate at the apex. Fruiting heads up to 2.3cm in diameter with numerous amphora-shaped capsules 5-8mm long; seeds numerous, 1.5mm long, flat, slightly winged.

Flowering period is between February and March and fruiting in June and July.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Mitragyna ledermannii and M. stipulosa have similar uses and in the Ivory Coast both are used as febrifuges. The physiological action of M. ledermannii is due the the alkaloids. such as mitrinermine, mitraphylline and mitraversine which have a local anaesthetic action, are poisonous to paramecia, cause lower arterial pressure, increase cardiac rhythm and cause considerable disturbance in the autonomous lymphatic cells of the intestine, (Kerharo and Bouquet, 1950). It is likely to find its way into European therapeutics.

According to Raymond Hamlet (1953) and Raymond Hamlet and Millat (1934) mitraphylline is hypotensive and depressant. Other reports on some alkaloids isolated from Mitragyna ledermannii are as follows:

Rynchophylline possesses antipyretic properties (Perrot et al., 1930) and is hypotensive, while Mitragynine has been shown to be a protozoal poison (Grewal, 1932) and to exert a depressant effect.

Mitragynine is also said to have analgesic properties equivalent to those of Codein but without any of its side-effects (Shellard, 1970). Various parts of the plant are claimed to be effective in the treatment of numerous ailments including gastro-intestinal disorders, gonorrhoea, fever, rheumatism, etc. (Dr. K. Sarpong (1975).

5. FOLK MEDICINAL USES

The bark and the leaves are sometimes used for gonorrhoea and dysentry. The bark boiled with Capsicum (pepper) seeds and those of Piper guineense are reputed a remedy for chest complaints in Equatorial Africa. A bark infusion with the bark of Coula edulis, Isolana letestui and Bertiera fistulosa with leaves of Alchornea cordifolia and other ingredients is used by the Bupunus to cure sterility in women (Walker, 1953). Women rub the powdered bark on their bodies.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

As mentioned previously the tree contains the Alkaloids mitrinermine, mitraphylline and mitraversine. The wood is resistant to acids.

The following alkaloids have also been isolated recently from Mitragyna ledermannii by research workers.

Name of Alkaloid	Research Workers
(i) OXINDOLES	
Isorhynchophylline	Badger, Cook and Ongley (1950)
Rotundifoline	Badger, Cook and Ongley (1950)
Rhynchophylline	Beckett, Shellard and Tackie (1963)
Insoratundifoline	Beckett, Shellard and Tackie (1963)
Rhychociline	Beckett, Shellard and Tackie (1963)
(ii) INDOLES	
Mitraciliatine	Beckett, Shellard and Tackie (1963)

7. HARVESTING, CONSERVING AND PREPARATION

The tree is exploited for timber. All the parts of the plant are obtainable from the felling sites. Methods of conserving and preparing the plant for use are the same as described under Chlorophora excelsa. The medicinal properties are extracted by boiling or steeping in water or alcohol.

8. ECONOMICS AND MARKETING

The tree yields valuable commercial timber under the trade name "Abura", and has both local and overseas markets.

9. SILVICS

Mitragyna ciliata thrives only in fresh water swamps. It is a light demander and it regenerates itself easily and profusely in its habitat. Height growth is said to be rapid. It cannot withstand competition for light.

The seeds are not easy to obtain and therefore this species has not been raised artificially on a large scale in plantations. Care is needed to separate the 1.5mm long seeds from the 4mm long bracts. Propagation by 12cm long stem cuttings has been tried successfully on an experimental basis and a height growth of 2.7m in three years and about 12m in nine years has been recorded (Taylor, 1960).

10. MAJOR DISEASES

None have been recorded in Ghana or elsewhere.

11. OTHER USES

The sapwood is white and the heartwood light pinkish yellow. It is moderately straight grained and of fine uniform texture. It weighs about 560kg/m^3 at about 12% moisture content and it seasons rapidly with no degrade. It is resistant to insects except termites but not resistant to decay. It is used for furniture, building materials, battery and accumulator boxes, laboratory fittings, light construction and veneer.

12. BIBLIOGRAPHY

Badger, G.M., Cook, J.W. and Ongley, P.A. J. Chem. Soc. 867 (1950)

Beckett, A.H., Shellard, E.J. and Tackie, A.N. J. Pharm., Pharm... Pharmacol. G.B. (1963) 15 Suppl. 158T - 165T and 166T.

Grewal, K.S. (1932) J. Pharm. Exp. Thev., 46 251

Kerharo, J. and Bouquet, A. (1950) Plantes médicinales et toxiques de la Côte d'Ivoire - Haute Volta, Paris: Vigot édit.

Perrot, E. (1929) Sur les productions végétables indigènes ou cultivées de l'Afrique occidentale français. Trav. Lab. Nat. Med. pt. 1, pp 1-468 Paris.

Perrot, E., Raymond - Hammet and Larrieu, P. Bull. Sci. Pharm. 37 401. (1930)

Raymond - Hamet C.R. Soc. Biol. Paris, 114 692. (1933)

Raymond - Hamet and Millat, L. C.R. Acad. Sci. Paris 199 587. (1934)

Sarpong, K. (1975) Studies in the metabolism of some Mitragyna alkaloids. (Ph.D. Thesis) London.

Shellard, E.J. (1970) Private Comm.

Taylor, C.J. (1960) Synecology and silviculture in Ghana. Edinburgh, Nelson & Sons.

Walker, Abbe A. (1953) Usages pharmacéutiques des plantes spontanées du Gabon. Bull de l'Inst. d'Etudes Centrafr. Nos. 4,5 and 6.

PLATE XXII. Mitragyna ledermannii (K.Krause)Ridsd.

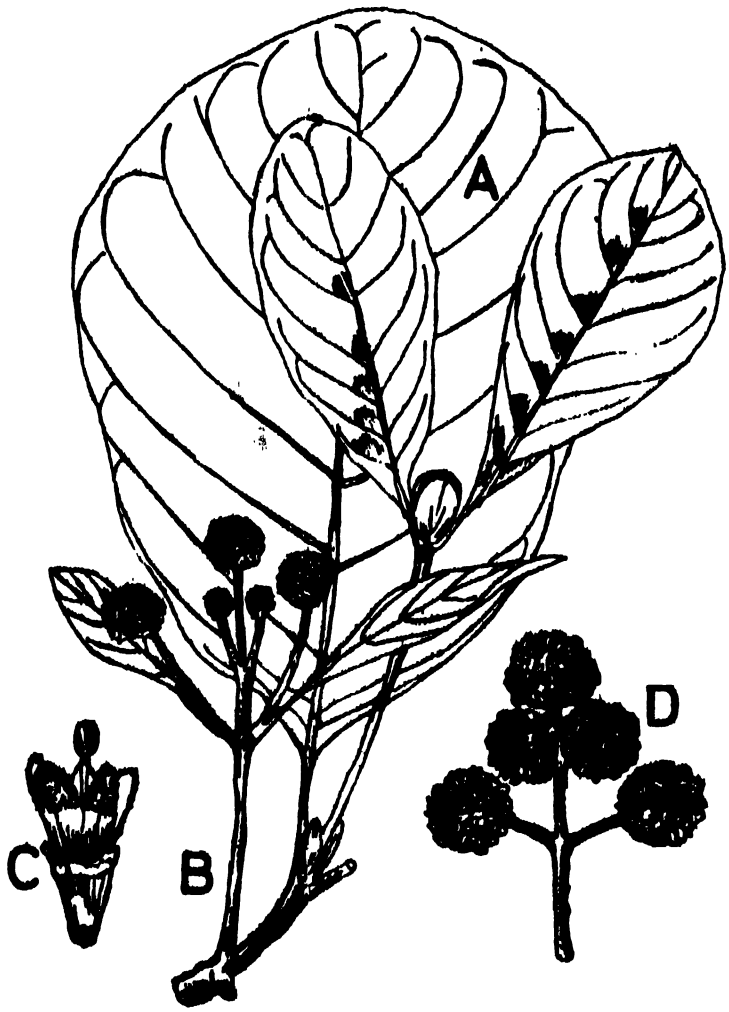


Plate XXII

Mitragyna ledermannii

(K. Krause) Ridsd.

A. leaves

B. flowering shoot

C. flower (enlarged)

D. fruits

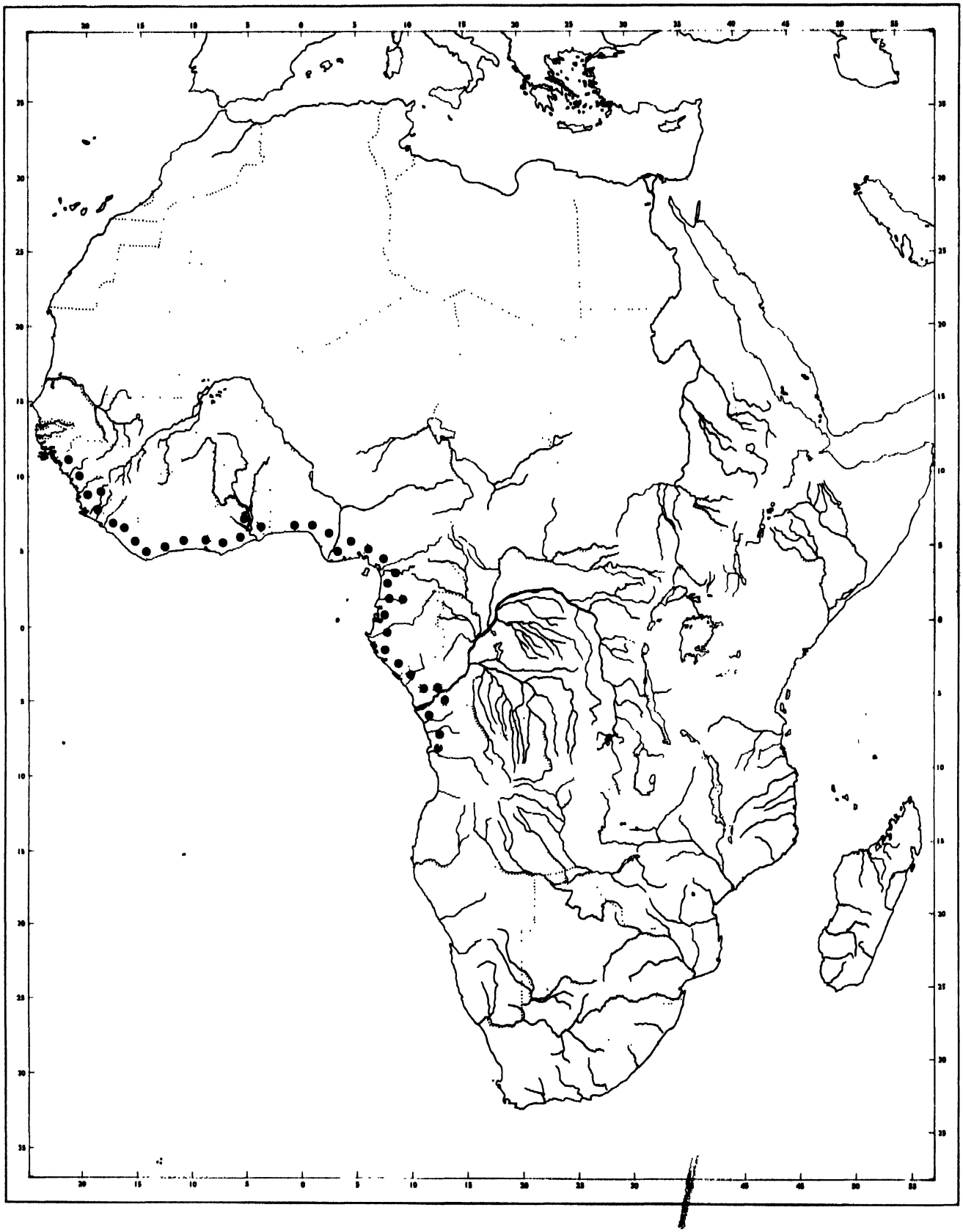
(After Keay et al. 1960)

Plate XXII - 1

Mitragyna ledermannii

Herbarium specimen of dried leaves

MAP 23 - Geographic distribution of Mitragyna ledermannii



1. BOTANICAL NAME: Myroxylon peruiferum (L) Harms.

FAMILY: Leguminosae subfamily Papilionoideae

COMMON NAMES: Balm, Balm of tolu, Balm wood, Quine-quine, Cabreuva, Caboreiba, Red oil.

2. ECOLOGY AND DISTRIBUTION

Myroxylon peruiferum is a slow-growing, long-lived tree of rocky terrain, river banks and fertile slopes.

It is widely distributed in South America, occurring in southern Mexico, Ecuador, Colombia, Peru, Bolivia, northern Argentina and Brazil, where it occurs in the States of Bahia, Minas Gerais, Sao Paulo, Mato Grosso, north of Parana and in the north east, where it occurs in the valleys between the mountains and is becoming increasingly rare due to exploitation (see distribution map). It has been introduced to southern Florida, West Indies, Sri Lanka and India.

3. DESCRIPTION

Tree up to 15m high; trunk up to 1m in diameter, bark brownish-grey, thick and wrinkled. Leaves alternate, compound; stipules inconspicuous, soon falling; rachis 13cm or more long; leaflets 1-5 alternate pairs with a larger, terminal leaflet, oblong-acuminate, up to 10cm long, 4cm wide, membraneous, glabrous, with gland-dots and resin canals. Inflorescence a simple axillary cluster; flowers small, irregular, bisexual; pedicels 15mm long. Calyx turbinate-campanulate, 4-6mm long, lobes 5, subequal; petals 5, free, subequal except for the larger standard, which is broadly orbicular, 12mm long, 8mm wide; stamens 10. Fruit an indehiscent, curved and winged pod, 5-8cm long, shortly stipitate, apex apiculate, aromatic; pericarp with irregular, resin-filled protuberances, the resin liquid at first, becoming thicker and exuding a strong smell; seeds 1-2, curved and wrinkled, oleaginous and aromatic.

Flowering September to October; fruiting November to December.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The oil is applied as a balm for chronic catarrhs, laringitis, pulmonary catarrhs and bronchitis. In the treatment of nervous asthma smoke is inhaled from "cigarettes" which are prepared with paper nitrates soaked in balm tincture.

Although it is perfumed and smelling similar to vanilla, it has a bitter and acrid taste. It is used in all diseases of the respiratory system, in infections in general, diseases of the uro-genital system, ulcers, erysipelas, leucorrhea and blenorrhea. The balm is usually utilized as a syrup and the dose indicated is of one small spoon diluted in one cup of water three time a day.

It is considered to have antiseptic and homoeostatic properties.

5. FOLK MEDICINAL USES

The balm together with the species Lantana camara L., known as "cambará" are used in homoeophaty, to medicate influenza, coughing and bronchitis.

According to Lewis et al (1977), the balm is used by South American Indians, to clean their teeth and is also used by the Incas and Colombians to staunch bleeding.

In the State of Minus Gerais, the bark is usually employed to overcome catarrhs, night sweat, coughing, skin eruption, to wash wounds, in the curing of colds, diseases of the bladder and in the treatment of scabies.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Balsam oil is the most utilized part in this species in popular medicine. It is an effective stimulant and diuretic containing: Cinnamein, Metacinnamein, Cinnamic, Benzoic acids and volatile oils, (Correia, 1926).

Rizzini (1971), quotes the balm as being utilized for respiratory diseases. It is frequently used as a sedative and expectorant candy.

Gottlieb (1982), indicates the species M. balsamum native in the Amazon as having essential oils which contain the substance Nerolidol.

Nowadays the balm is mainly utilized in perfumery articles and in sedative candy for coughs.

7. HARVESTING, CONSERVING AND PREPARATION

The popular name of this species is due to the dark brown perfumed oil which it exudes from its trunk when perforated. It is obtained through long and deep incisions in the trunks from top to bottom, from which the oil slowly flows, reaching up to 8 or 10 kg each time the process is carried out. It is a colourless and almost transparent fluid, that with time, gradually hardens becoming solid and reddish in colour.

It is a drugstore variety known as "balm of Tolu" and as "Balsam d'Amérique" by the French. After this procedure, the incisions are closed with clay. The healing and replacing of wounded tissue is more efficient in young plants, while older plants often reveal holes in their trunks (Nogueira, 1982). Another closely related species of the "balm" is Toluifera balsamo L., which is obtained and used in popular medicine with the same purposes as the "balm".

8. ECONOMICS AND MARKETING

Excellent wood, the heart wood being brownish-red, thinly striped, somewhat rough and with a peculiar smell (it contains distillable essential oil); heavy, hard and resists deterioration. The sapwood has a purplish-green colour and deteriorates rapidly, leaving the duramen, a high quality wood of great durability which offers timber of excellent quality.

Manieri (1970), indicates this wood as one of good quality, which can be used in urban and naval construction for the bodies of vehicles, bridges, tiles and handles of

work tools. It is also frequently used in furniture, external and submerged construction, being preferred for the manufacture of barrels, large casks and small anchors.

This species, although having a wood of excellent quality, is better known for containing essential oils in its structures, specially in the trunk. This oil was much used in the past in popular medicine, being nowadays more utilized in perfumery articles.

Nogueira et al. (1982), cite research using different spacing in planting and cultivation of M. peruiferum (L.) Harms, and recommend it as a promising native species, as it grows rapidly and its wood and oils are of great utility.

There are no anatomy studies on the structure of this species in Brazilian literature.

9. SILVICS

The tree can be grown from seed and has been introduced to Southern Florida, Sri Lanka, Ceylon, India and West Africa. It is sometimes used as an ornamental or as a shade tree for crops such as coffee.

10. MAJOR DISEASES

None specified.

11. OTHER USES

The balm is used in the manufacture of perfumes.

12. BIBLIOGRAPHY

Barros, M.A.F. e (1982) — Flora Medicinal do Distrito Federal. Brasil Florestal, Brasil 12(50): 35-45.

Barroso, G.M. (1978) — Sistemática de Angiospermas do Brasil. Livros Técnicos e Científicos Ed. S.A./Ed. da Un. de S. Paulo. Volume I. S. Paulo, 255 p.

Braga, R. (1960) — Plantas do Nordeste, especialmente do Ceará. 2a. Ed. Imprensa oficial do Ceará, Fortaleza - Brasil. 540 p.

Carvalho, R.F. de (1976) — Alguns dados Fenológicos de 100 espécies florestais, ornamentais e frutíferas, nativas ou introduzidas na Eflex de Saltinho, PE. Brasil Florestal, Brasília, D.F. 7(25): 42-44.

Chiriani, C.H.B. (1974) — La Vuelta a los vegetales. Copyright by Libreria Hachette 5.A. Argentina. 631 p.

Conceição, M. (1980) — As plantas medicinais no ano 2000. Tao Livraria e editoria. 152 p.

Correia, M.P. (1926-1969) — Dicionário das Plantas Úteis do Brasil e das Exóticas Cultivadas. Rio de Janeiro. Imprensa Oficial. IBDF. Rio de Janeiro, Brasil. 6 v.

Cruz, G.L. (1982) Dicionário das Plantas Úteis do Brasil. Ed. Civilizaçao Brasileira S.A. Rio de Janeiro. Brasil. 599 p.

Duke, J.A. (1981) Handbook of Legumes of World Economic importance. Plenum New York and London, pages 173-177.

Ferreira, M.B. (1980) Plantas Portadoras de Substâncias Medicamentosas de Uso Popular, nos Cerrado de Minas Gerais. Inf. Agropecuario. Belo Horizonte. 6(61): 19-23.

Gottlieb, O.R. (1982) Ethnopharmacology versus chemosystematics in the search of biologically active principles in plants. J. Ethnopharm. 6(2): 227-238.

Gurgel, F.O. de, Morais, J.L. and Gurgel-Garrido, L.M. do (1982) Espécies Nativas Euxilóforas. In Anais do Congresso Nacional sobre Essências Nativas. Inst. Florestal. Sao Paulo, Brasil. Vol. 16A(2): 890-894.

Hoehne, F.C. (1978) Plantas e Substâncias Vegetais Tóxicas e Medicinais. Departamento de Botânica do Estado de S. Paulo. Ed. Novos Horizontes, Sao Paulo. 355 p.

Hoehne, F.C. (1979) Frutas Indígenas. Instituto de Botânica, Secretaria da Agricultura Indústria e Comércio, S. Paulo. Brasil. 88 p.

Kirkbride, M.C.G. de (1981) A Preliminary Phylogeny for The Neotropical Rubiaceae. Pl. Syst. Evol. Springer Verlag, Austria. 141,115-122.

Lainetti, R. and Brito, N.R.S. (1979) A Cura Pelas Ervas e Plantas Medicinais Brasileiras. Ed. Ouro. DF, Brasil. 169 p.

Lewis, W.H. e M.P.F. Elvin Lewis (1977) Medical Botany, Wiley & Sons, N.Y. 515 p.

Manieri, C. (1970) Madeiras brasileiras, características gerais, zonas de maior ocorrência, dados botânicos e usos. Sao Paulo, Inst. Florestal. 109 p.

Nogueira, J.C.B. (1977) Reflorestamento heterogêneo com essências indígenas. Bol. Téc., S. Paulo 24, 1-77.

Nogueira, J.C.B., Siqueira, A.C.M.F., Morais, E. and Zandarin, M.A. (1982) Plantio de Cabreuva - Myroxylon peruiferum L.F. em diferentes espaçamentos. In Anais do Congresso Nacional sobre Essências Nativas. Inst. Florestal. S. Paulo. Vol. 16A: (2): 1064-1069.

Paula, J.E. de and Heringer, E.P. (1978) Estudo anatômico de Anacardium curatelifolium St. Hil. com vistas a sua forma e àsbolsas oleíferas. Brasil Florestal. Brasília, Brasil, 34, 33-39.

Paula, J.E. de (1981) Estudo das estruturas internas das madeiras de dezesseis espécies da Flora Brasileira visando o aproveitamento econômico para produçao de álcool, carvao, coque e papel. Brasil Florestal II (47): 23-50.

Paula, J.E. de (1982) Espécies nativas com perspectivas Energéticas. In Anais do Congresso Nactional sobre Essências Nativas. Inst. Florestal. S. Paulo. Vol. 16A (2): 1259-1316.

Ratter, J.A., Richards, P.W., Argent, G., and Gifford, D.R. (1977) Observaçoes adicionais sobre o cerradao de solos mesotróficos no Brasil Central. In IV Simpósio Sobre o Cerrado. S. Paulo. p. 303-316.

Ratter, J.A. (1980) Notes on the vegetation of Fazenda Água Limpa. Royal Botanic Garden, Edinburgh, Scotland, 111 p.

Rizzini, C.T. (1971) Árvores e madeiras úteis do Brasil. Manual de Dendrologia Brasileira. Ed. Edgard Blücher Ltda. Ed. da Univ. de Sao Paulo. 294 p.

Rizzini, C.T. and Mors, W.B. (1976) Botânica Econômica Brasileira. EDUSP, E.P.U. Sao Paulo. 207 p

Salomao, A.L.F. and Silva L. da L. Angico Vermelho. Brasil Florestal. IBDF, Brasília, (1982) D.F. 10(41): 45-50.

Tortorelli, L.A. (1956) Madeiras & bosques argentinos. Ed. ACME S.A.C.I. 910 p.

PLATE XXIII. Myroxylon peruiferum (L) Harms.

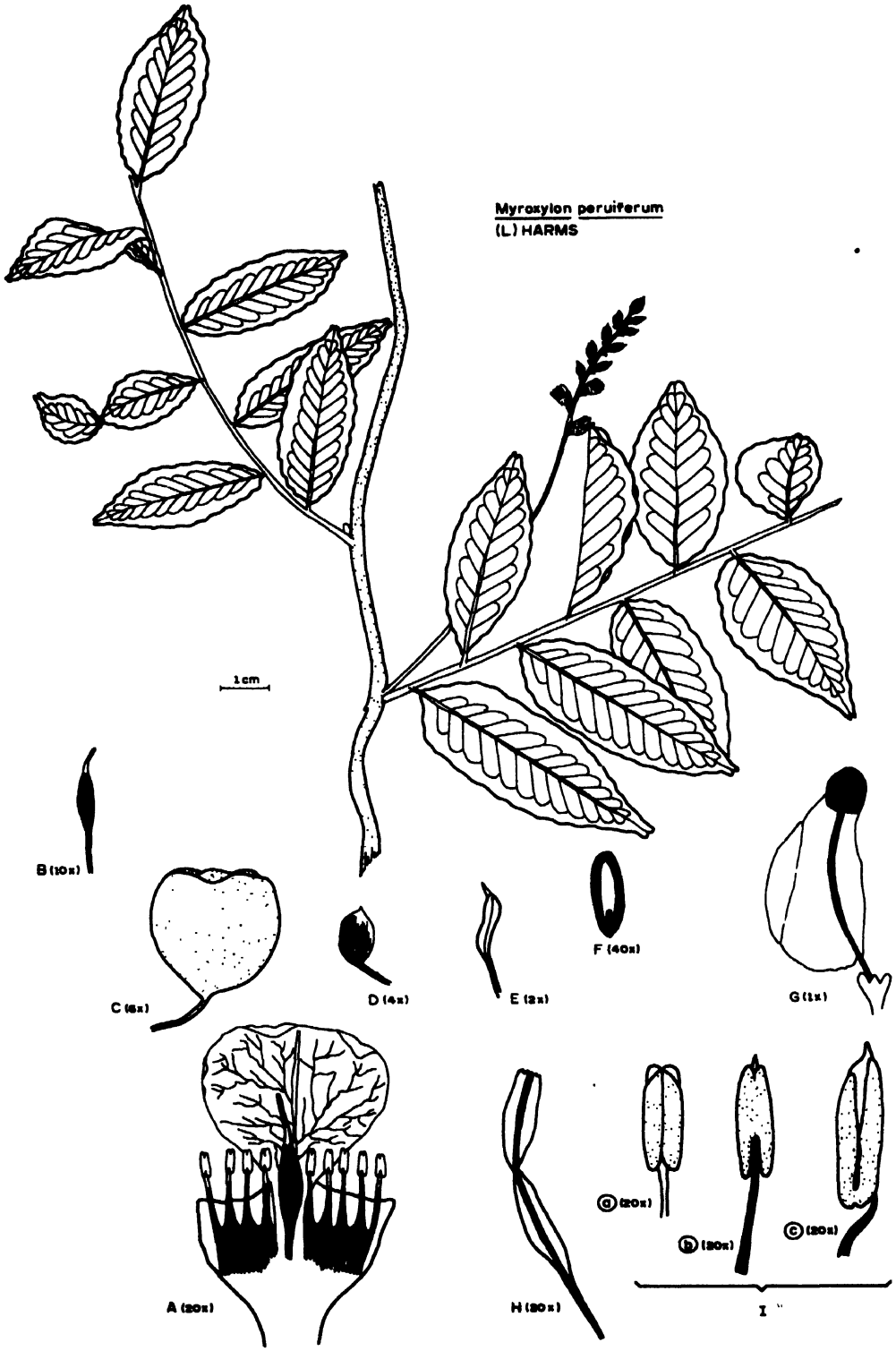


Plate XXIII. Myroxylon peruiferum (L.) Harms.
A. longitudinal section of flower B. gynoecium C. detail of calyx
D. floral bud E. very young fruit F. cross section of ovary
G. fruit H. staminoid I. stamen
a. frontal view b. dorsal view c. lateral view
(From Heringer, E.P. exsiccate 12159 UB)

MAP 23 - Geographic distribution of Myroxylon peruiferum

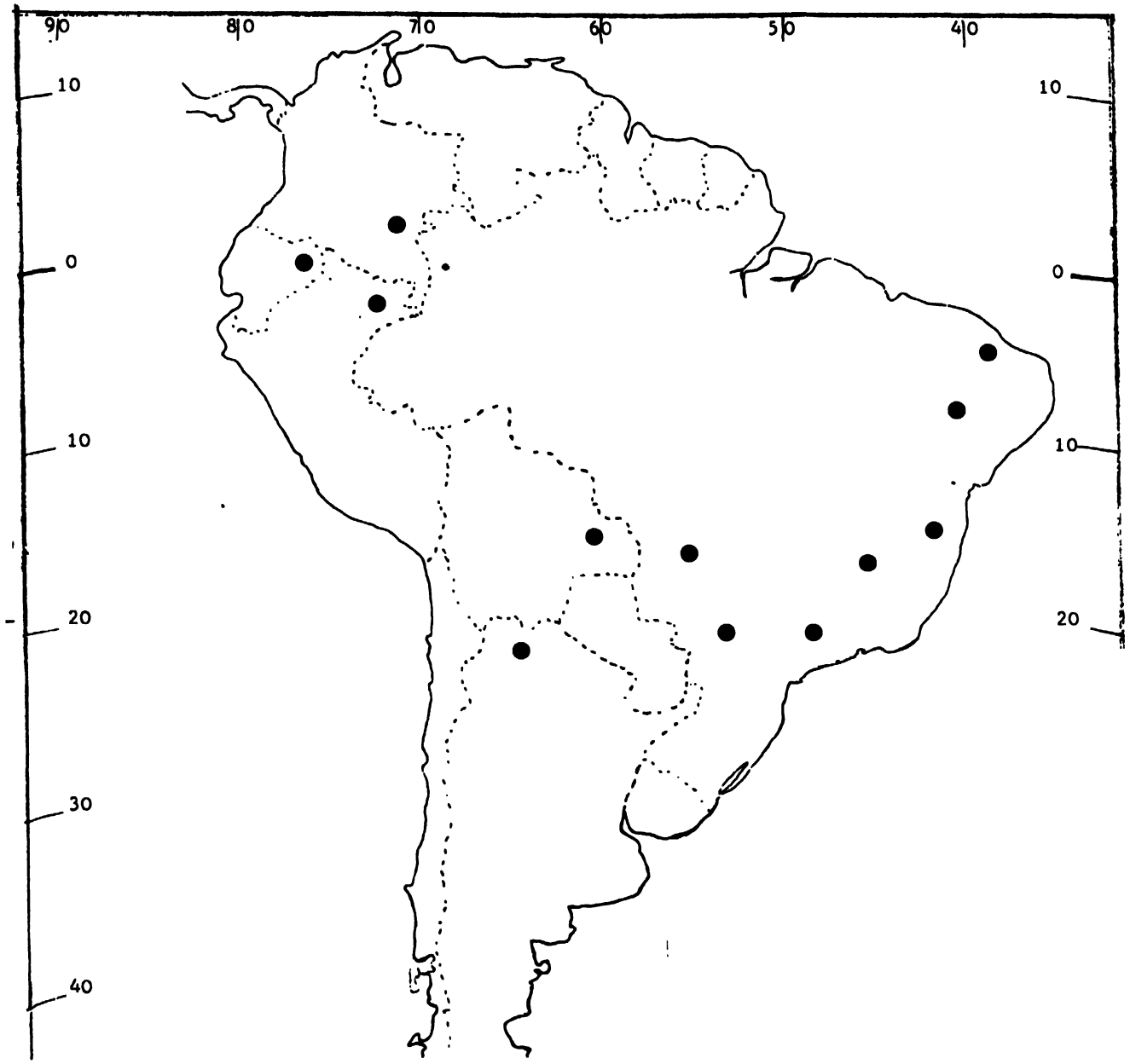


Plate XXIII-1

Herbarium specimen
University of Brasilia

1. BOTANICAL NAME: Ocimum suave Willd.

SYNONYMS: Ocimum trichodon Bak.
Ocimum dalabaense A. Chev.

FAMILY: Labiate

COMMON NAMES: Umwenya (Rwanda); Msumbasha, Mvumbasha (Kisambaa), Mrumbasha, Muodo (Kipare), Induka, Mnuka (Kimeru), Kifumbazi (Kirufiji), Manyinyiikwa (Kimasai), Kivumbashi (Kiswahili, Kiluguru), Olmanyinyikwa olemura (Kiarusha), Msuameno (Kiluguru), Iwenya, Mzenye, Izenhye (Kigogo), Inengafai, Ijumbaei, Idumbasi (Kinyiramba), Lumbasi (Kinyaturu), Ilumbasya (Kinyamwezi), Lwenye (Kihehe).

2. ECOLOGY AND DISTRIBUTION

Ocimum suave is a widely distributed savanna species occurring on a wide range of soils at altitudes between 100 and 2000m in areas receiving between 500 and 1500mm or more annual rainfall.

The species is widely distributed in tropical and southern Africa and has been recorded from Sierra Leone, Guinea, Ivory Coast, Nigeria, Cameroon, Zaire, Rwanda, Burundi, Sudan, Ethiopia, Somalia, Uganda, Kenya, Tanzania, Malawi, Zambia, Zimbabwe, Botswana, Angola, Namibia and South Africa, also from N. Yemen and Comoro Islands (see distribution map). It has been introduced into the West Indies and South America.

3. DESCRIPTION

A much-branched herb or shrub 1-4m high; stem ribbed, branchlets pubescent or glabrous. Leaves opposite, simple, stipules absent; blade ovate to ovate-lanceolate or lanceolate, 3-12cm long, 1-6cm wide, apex acuminate, base cuneate, margins bluntly serrate, pubescent, aromatic when crushed. Inflorescence terminal, simple or paniculate racemes; flowers in whorls, hermaphrodite, 5-merous, irregular. Calyx campanulate, 5-7mm long, hairy, upper lip oval, as long as the tube, lower lip with 4 triangular teeth; corolla whitish or greenish-yellow, tube more or less equalling the calyx, upper lip 4-lobed, somewhat hooded; stamens 4, unequal; apex of style 2-fid. Achenes brownish-green ovoid, c. 1mm long.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Chhdra (Pers. Comm.) observed that O. suave has disinfectant and insecticide properties; and that it is mainly used in perfumes and in the preparation of some pharmaceuticals. Harjula (1980) reports that eugend is an oral analgesic and topical anaesthetic used by dentists as an alternative to clove oil. It helps control the pain of caries and root canal work. It is rarely administered internally. Eugend is one of the basic materials in the production of vanilin.

5. FOLK MEDICINAL USES

Kokwaro (1976) reports that the strongly-scented leaves of the plant are rubbed between the palms and sniffed as a treatment for blocked nostrils. The leaves are also used for abdominal pains, sore eyes, ear troubles, and for coughs. Watt and Breyer-Brandwijk (1962) observed that the herb is used as a stomachic.

Harjula (1980) reports that pieces of the roots are boiled; 3 pieces of about 20cm in length and 1cm diameter yield a dose of 1 glassful, which is taken twice a day as a treatment for barrenness. A survey carried out during the course of this study revealed that the leaves of O. suave are also used to cure colds, coughs, fever convulsions, stomach-ache, as a tooth gargle, to regulate menstruation and cure prolapse of the rectum.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Watt and Breyer-Brandwijk (1962) observed that the plant contains a volatile oil which has 53 per cent phenol paractically all eugenol.

7. HARVESTING, CONSERVING AND PREPARATION

Leaves are plucked, pounded and boiled to form a decoction or pounded leaves are used to prepare an infusion. Roots are excavated, cut into pieces and boiled to form a decoction. Root pieces can also be put in water to form an infusion. Both plant leaves and roots are air dried, tied into bundles and stored in a dry place.

8. ECONOMICS AND MARKETING

There have been no studies on the economics and marketability of O. suave. Due to the fact that O. suave is a remedy for various diseases, there are prospects that after the isolation of the effective ingredients and research into the best means of administering them, the plant parts will fetch a higher price.

9. SILVICS

The species regenerates naturally by coppice and from seed. Coppice is produced on cutting of the main stem. O. suave produces seeds heavily throughout the year. Thus, under suitable conditions, natural regeneration from seed is often profuse. The species prefers open areas and does not tolerate shade.

There has been no effort to regenerate the species artificially. However, there is a good potential for regenerating the species artificially as the seed germinates readily and can be raised by direct sowing on cultivated areas. Since the species does not tolerate shade, it might be necessary to carry out weeding in order to reduce competition for light.

10. MAJOR DISEASES

None specified.

11. OTHER USES

The leaf of O. suave is used to perfume chewing tobacco and snuff.

The smoke from burning the plant is used as a mosquito repellent.

The plant is used as a charm against evil spirits.

12. BIBLIOGRAPHY

Brenan, J.P.M. and Greenway, P.J. (1949) Check-List of the Forest Trees and Shrubs of the British Empire. No. 5 Tanganyika Territory. Imp. For. Inst. Oxford. 653.

Harjula, H. (1980) Mirau and his Practice. A study of the Ethnomedicinal Repertoire of a Tanzanian Herbalist. Tri-Med. Books London. 223.

Kokwaro, J.O. (1976) Medicinal Plants of East Africa. E.A. Literature Bureau. Nairobi.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa. E. & S. Livingstone Ltd. London. 1455.

PLATE XXIV. Ocimum suave Willd.

Plate XXIV. Ocimum suave Willd.
branchlet bearing flower-buds and flowers

Plate XXIV-1 Plant at Muheza, Tanga, May, 1983 (Photo Ruffo)

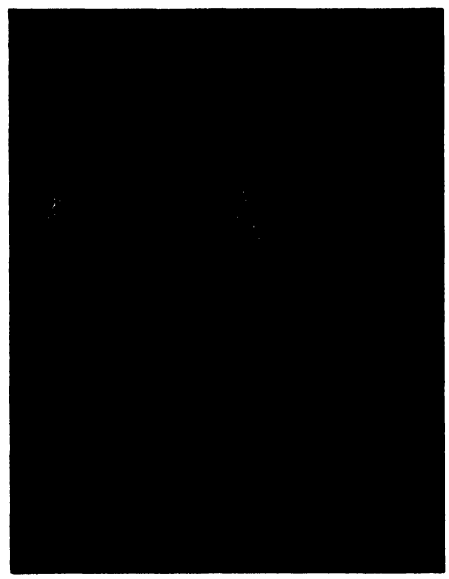
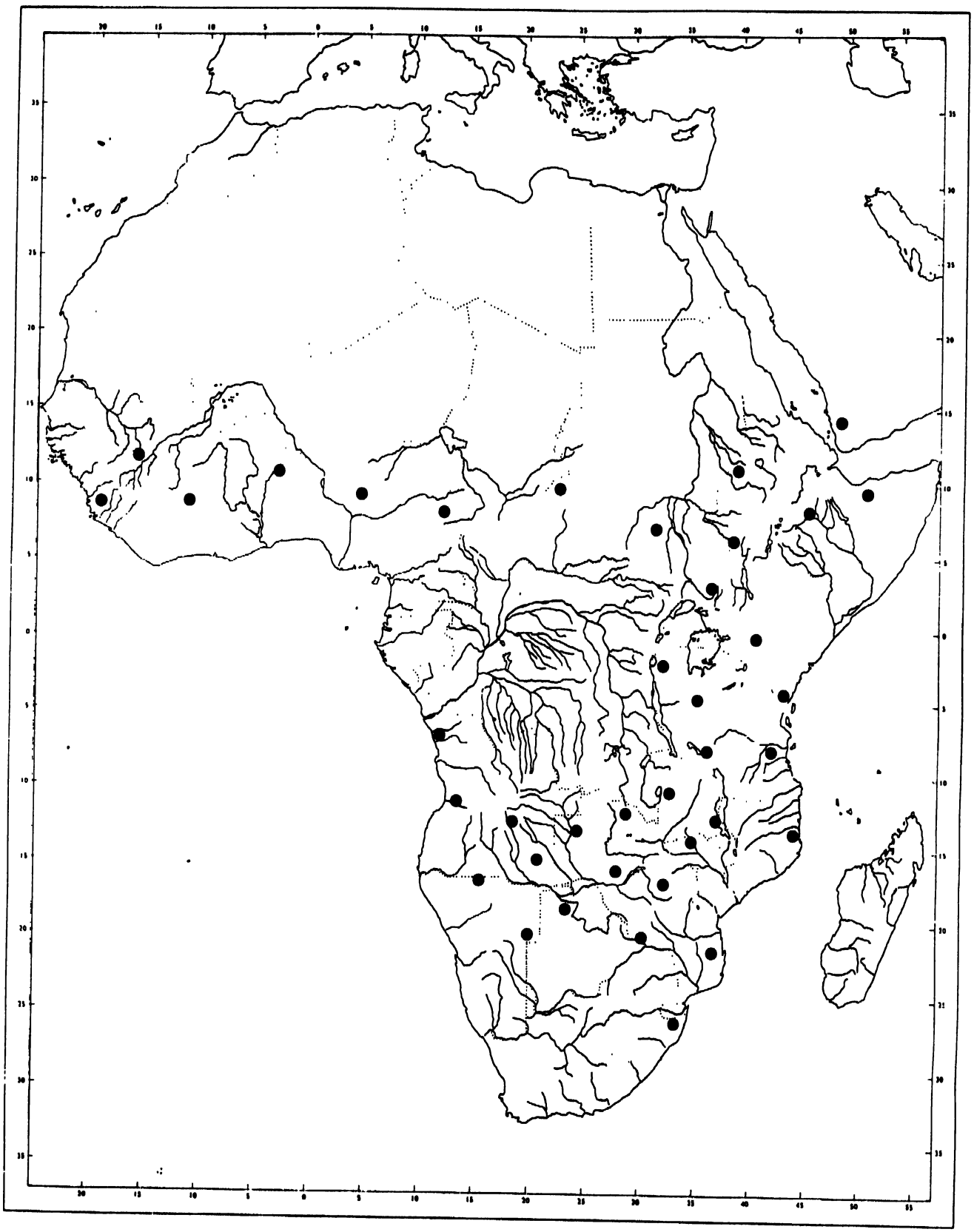


Plate XXIV-2 branchlet bearing flower-buds and flowers (Photo Ruffo)

MAP 24 - Geographic distribution of Ocimum suave



1. BOTANICAL NAME: *Persea americana* Mill.

SYNONYMS: *Laurus persea* L.
Persea persea (L.) Cockerell
Persea gratissima Gaertn.f.

FAMILY: Lauraceae

COMMON NAMES: Avocado pear, Alligator pear, Mexican avocado, West Indian avocado, Guatemala avodaco; Aguacate, Aguacate de mico, Veranero, Avocatier, Avoca, Huita palta, Palto (Mexico), Zihene (Zapoteco), Cupanda (Purepecha), Kirtum (Mixe), On (Maya), Tzatzan (Otomí), Ahuacaquáhuitl - tree, Ahuácatl - fruit (Aztec).

2. ECOLOGY AND DISTRIBUTION

A native of Mexico and now widely cultivated throughout the tropics and subtropics of the world, its natural habitat and distribution is now somewhat obscured.

Three varieties are recognized in Mexico. There is archeological evidence that in 7000 B.C. var. *drymifolia* was being used for food in the Valley of Tehuacán, Puebla. It is still widely grown in the Valley of Orizaba, Veracruz and in the region around the Valley of Mexico. Its small, ovoid, black fruit is much valued as a food commodity and its leaves are characterized by a fragrance similar to that of aniseed. By the time the Spaniards arrived two further varieties were being grown by the inhabitants of Mexico. The West Indian avocado, var. *americana* has larger, pear-shaped fruit, usually with a think, green skin. The Guatemala avocado is even larger, rounded and with a thick, wrinkled, dark green skin. (See distribution map.)

3. DESCRIPTION

An evergreen tree up to 14(-14)m high; young branches glabrous or glaucous; crown very dense, rounded or elongated. *Leaves* spirally arranged, simple; stipules absent; petiole 1.5-6cm long; blade narrowly to broadly elliptic or obovate, 5-30cm long, 3-19cm wide, apex usually acute or acuminate, base unequally cuneate to rounded, margins entire, chartaceous, dark green and glabrous above, glaucous below. *Inflorescence* dense, greyish pubescent or sericeous, axillary panicles 6-20cm long; flowers many, bisexual, fragrant; pedicels slender, bracts lanceolate, 4mm long, deciduous. Perianth segments 6, in 2 whorls, greenish-yellow, tomentose, outer whorl 4-6mm long, inner slightly longer; stamens 9, in 3 whorls, inner whorl longer, each with 2 orange nectaries at the base, staminodes 3, in innermost whorl; ovary 1-celled, style slender, hirsute. *Fruit* globose to pear-shaped, 3-20cm long, epicarp yellow-green to maroon and purple, mesocarp yellowish green, butter-like consistency, edible. Seed 1, globose-pear-shaped, c.6cm long.

Flowers between May and August in Mexico.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None known.

5. FOLK MEDICINAL UESES

The avocado has been used for medicinal as well as food purposes from very ancient times. According to indigenous informers in the period immediately following the Spanish conquest of Mexico, the seed of P. americana, ground and made into an ointment, was used to treat various skin afflictions, such as scabies, purulent wounds, lesions of the scalp and dandruff.

Later it was realized that the oil extracted from the seed has astringent properties, and an oral infusion of the leaves was used to treat dysentery. The anthelmintic properties attributed to the skin of the fruit have been recognized by the people for many centuries. In Mexican medical literature spasmolitic and abortive properties are attributed to P. americana.

In Mexico now the skin of the fruit and the leaves are used to treat various infections of the skin and digestive ailments. Infusions of the leaves and skin are prepared for the treatment of dysentery, and plasters made using the abundant oil of the seed.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Chemical study of the avocado has been concentrated basically on the fruit, because of its food value. The pulp and the seed are rich in fatty acids, such as oleic, linolic, palmitic, stearic, linolenic, capric and miristic acid, which constitute 80 percent of the fruit's fatty contents. The oil of the seed is rich in tocopherol. Other substances present in the fruit are esculin and a numerous group of saturated aliphatic hydrocarbons, aliphatic alcohols and terpenes, esterols (Beta-sitosterol) and an unsaturated poliol. Recently the fruit has been shown to contain considerable amounts of gamma amminobutiric acid. Among the glucides, d-perseita or d-alfa-manoheptite and d-manoheptulose and persiteol or d-glycerol, d-galactoheptitol stand out. Protocyanidine, carnitine and carotenoides are very abundant in the seed.

The leaves of the tree contain mainly a yellowish-green essential oil, composed of estragol, d-pinene, cineole, transanetole, alcanfore and traces of enantic acid, gamma metilionone, beta pinene and limonene. Watery extracts of the avocado leaves, in addition to their high content of essential oil, contain dopamine and serotonine, flavonoides, perseite, periteole and a bitter principle called abacatine.

Despite the extensive chemical knowledge of the composition of avocado, the medicinal effects of preparation from it have not been fully studied. Some organic extracts of avocado seeds possess antibiotic effects on Bacillus coli, Micrococcus pyogenes, Sarcina lutea and Staphylococcus aureus. The long-chain aliphatic compounds obtained from the seed, such as 1,2,4 trihydroxy-n-hepadeca-16-eno, are responsible for the antibiotic effect already proved on Salmonella typhi, Strigella dysenteriae and Candida albicans, which explains the traditional use made of avocado to combat infection.

Recently anti-cancerous activity has been reported in extracts of leaves and fresh shoots of avocado, studied in adenocarcinoma 755 tumours in laboratory animals.

7. HARVESTING, CONSERVING AND PREPARATION

Collection of skin of fruit, leaves and fresh shoots.

8. ECONOMICS AND MARKETING

Individual trees may yield up to 136 Kg of fruit per year and this aspect of the species production is well written up. There is no information on the marketing of its medicinal products which are most likely to be collected and used domestically or collected and sold by herb vendors (Morton, 1981).

9. SILVICS

The Avocado is readily grown from seed.

10. MAJOR DISEASES

Root-rot infection by Phytophthera cinnamomi has been experienced in Kenya (Bergh, 1980) and Verticillium wilt is another soil fungus borne disease (Williams and Chew, 1980) and are a major limiting factor (Martin, 1984). Rots of the surface and stem and of the fruit are caused by the fungi Colletotrichum spp. and Dothiorella spp. which together with Cercospora leaf spot can be controlled by appropriate fungicidal sprays (Williams and Chew, 1980). The species is attacked by a number of insect pests among them larvae of the Helivus genus of beetles feeding on seeds of developing fruit and burrowing into trees. The fruit, leaves and flowers are subject to attack by a wide range of pests, but generally within its native range (Martin, 1984).

11. OTHER USES

The fruit is much valued as a food commodity and the leaves are characterized by the fragrance they release, similar to the scent of aniseed. The unripe fruit is poisonous and the ground-up seed mixed with cheese is used as a rat and mouse killer. A fluid extracted from the seed is used as ink (Morton, 1981).

12. BIBLIOGRAPHY

Abbott, B. et al. (1966) — Cancer Res. 26:2.

Acosta de Iglesias, et. al. (1976) — Rev. Ital. Essenze Profumi Plante Off. Aromi. RIPOAM. 58(3): 158.

Bergh, B. et al. (1973) — Bot. Gas. 134(2): 130.

Bergh, B. (1980) — The Avocado in Kenya. FAO, AG: DP/KEN/75/028 Consultant Report No. 1.

Brown, B. (1972) — J. Agr. Food. Chem. 20(4): 753

Brown, B. (1973) — J. Chromatogr. 86(1): 239

Cowan, F.K. (1975) — Anthropological Papers, Museum of Anthropology. Univ. of Michigan. 60: 118.

Gazit, et al. (1972) — Physiol. Plant. 27(1): 77.

Geissman, D. (1965) Phytochemistry. 4: 359

Giral, F. and Sanguinés, T.V. (1954) Ciencia. 13(11-12): 264

Gross, J. et al. (1972) J. Food. Sci. 37(4): 589

Gross, J. et al. (1973) Phytochemistry. 12(9): 2259

Gross, J. et al. (1974) Phytochemistry. 13(9): 1919

Kahn, V. (1976) Phytochemistry. 15(2): 267

Martin, F.W. (1984) Handbook of Tropical Food Crops, CRC Press Inc., Baton Rouge, Florida, U.S.A.

McPherson, F. et al. (1975) Biochem. Soc. Trans. 3(2): 281.

Morton, J.F. (1981) Atlas of Medicinal Plants of Middle America, Bahamas to Yucatan, C.C. Thomas, Publisher, Springfield, ILL., U.S.A.

Neeman, I. et al. (1970) J. Appl. Microb. 19: 470

Nogueira Prista, L. et al. (1962) García de Orta, Lisboa. 10,3: 501

Ramírez, A. (1937) An. Inst. Biol. Univ. Nal. Autón. Méx. 8(1): 83

Rivera, M.I. (1943) An. Inst. Biol. Univ. Nal. Autón. Méx. 14: 37

Sharma, C. et al. (1972) J. Am. Oil. CHem. Soc. 49(4): 229

Udenfriend, et al. (1959) Arch. Biochem. Biophys. 85: 487

Valeri, A. et al. (1954) Rev. Méd. Veter. y Parasitol. 13: 37

Williams, C.N., Chew, W.Y. and Rajaratnam, J.H. (1979) Tree and Field Crops of the Wetter Regions of the Tropics, Longman Group Ltd., London.

PLATE XXXV. Persea americana Mill.

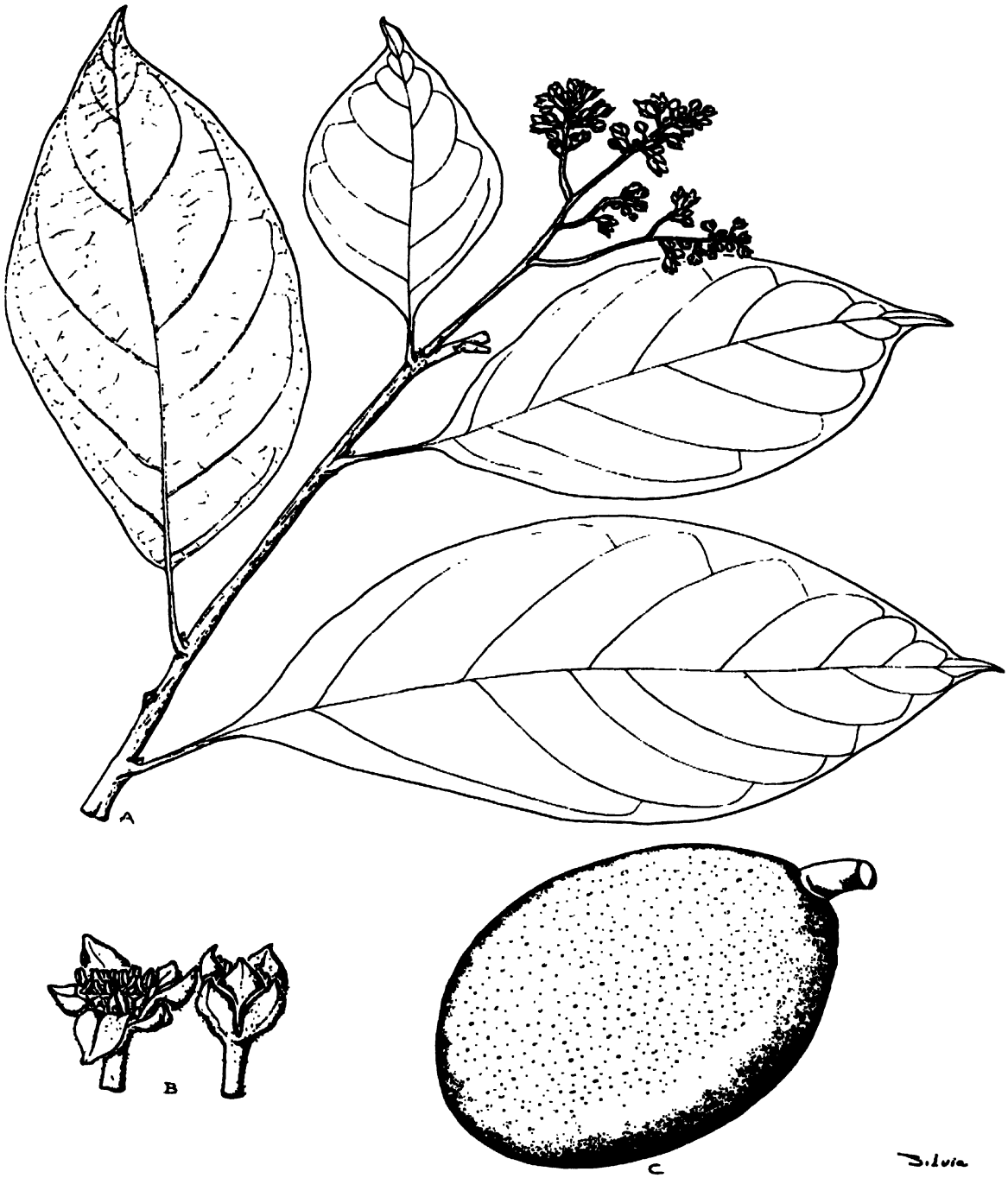
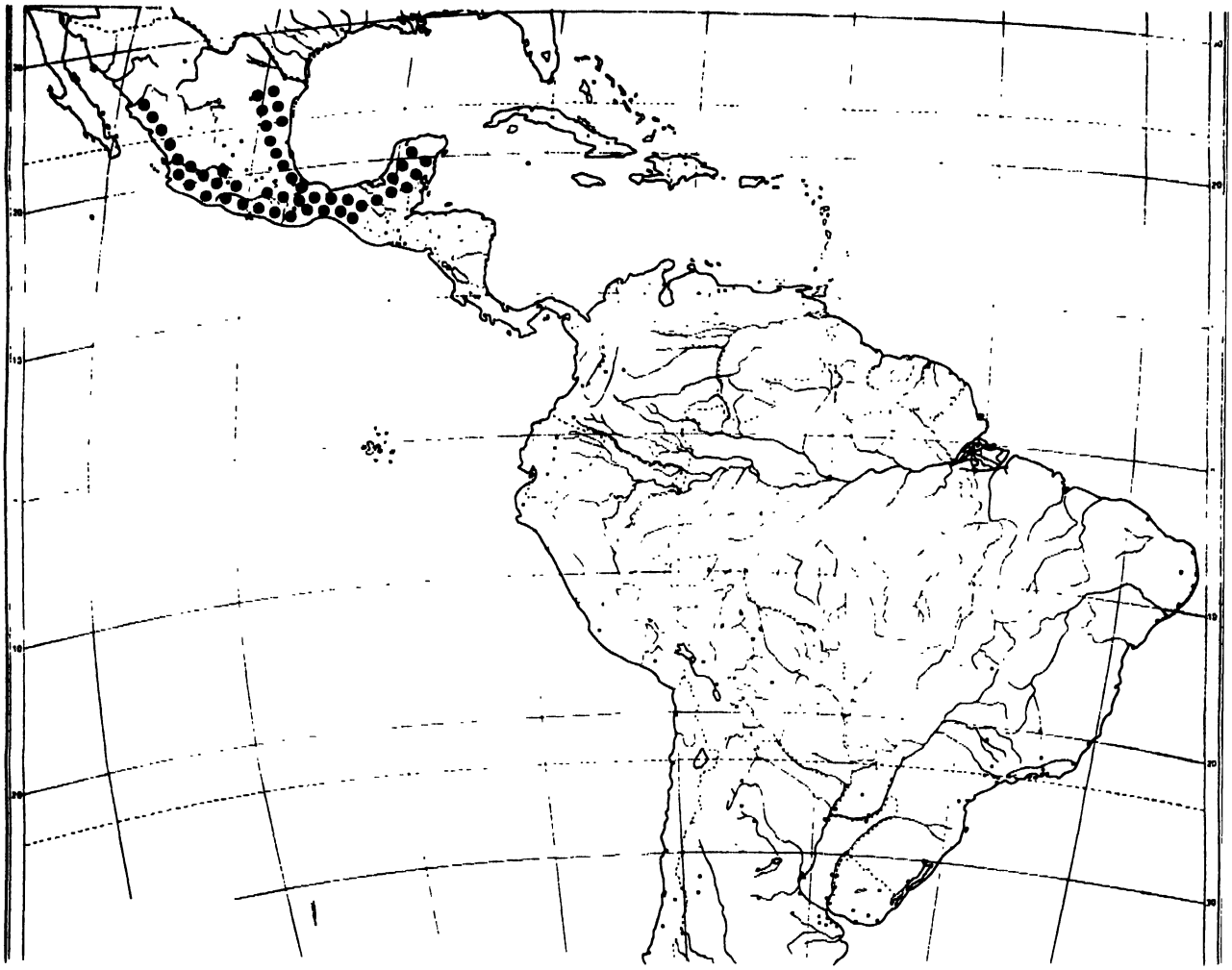


Plate XXXV. Persea americana Mill.

A. branchlet with inflorescence (x ½)
B. flowers (x 3)
C. fruit (x ½)
(Source: Pennington T.D. and Sarukhan S. (1968) Manual para la Identificacion de Campo de los Principales Arboles Tropicales de Mexico UNDP/FAO/INIF, Mexico)

MAP 25. Geographic distribution of Persea americana Mill. in Mexico



1. BOTANICAL NAME: Psychotria ipecacuanha (Brot.) Stokes

SYNONYMS: Cephaelis ipecacuanha (Brot.) A. Rich.
Cephaelis emetica Pers.
Evea ipecuanha (Brot.) Standley
Ipecacuanha officinalis Ars. Cam.
Psychotria emetica (Pers.) Vell.

FAMILY: Rubiaceae

COMMON NAMES: Ipecacuanha, Papaconha, Ipeca, Cipó emético (Brazil); Ipecacuan (England); Ipecacuanna (Holland); Ipecacuane (Italy); Brazilian ipecae (U.S.A.); Racille (Colombia); Racine d'ipecacuanha (France).

2. ECOLOGY AND DISTRIBUTION

Psychotria ipecacuanha occurs on acid soils, in shaded sites within the transitional forest of the Amazon basin.

It is native to Brazil and grows wild in the States of Amazonia, Pará, Goiás, Minas Gerais and Espírito Santo, with an important centre of dispersal in the south of Mato Grosso and Rondonia (Cruz, 1982). (See distribution map). The Mato Grosso 'poaeira' centre of dispersal, a particularly rich source of ipecacuanha, extends into the thinly forested right bank of the Alto Paraguai river and its tributaries.It has been introduced and is now widely cultivated in many parts of the tropics.

3. DESCRIPTION

Low, straggling to erect, rhizomatous shrub up to 40cm high; stem 3-5mm in diameter, dull brown, glabrous, little branched; slender rhizome bearing horizontally spreading fibrous roots, the latter whitish, smooth and slender when young, later thickening, with a brownish bark and becoming annulated. Leaves opposite, simple; stipules laciniate, united at the base to appear as 1 pair, 6-9mm long; petiole 3-5mm long; blade narrowly elliptic to obovoid, 5-9cm long, 3-6cm wide, apex acute, base cuneate, margins entire, scabrid and shortly adpressed pubescent above, adpressed pubescent below. Inflorescence a small, terminal capitulum, peduncle 1-2cm long, bracts rhomboid or obovoid, 6mm long. Calyx cup-shaped with 5 triangular teeth; corolla white, tubular-funnel-shaped, 5-6mm long, scabrid, 5-lobed; stamens 5, inserted on the tube, anthers exerted later. Fruit a whitish, ellipsoid berry 7mm long, 4mm in diameter; 2-seeded.

No information on flowering and fruiting periods.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Syrup of Ipecac is often given at the onset of acute bronchitis and croup. The hydrated chloride of emetine, administrated by injection is useful against amoebic dysentery and has been used in India against bilharziasis, guinea worms and oriental sores (Morton, 1977).

5. FOLK MEDICINAL USES

The root powder is employed as emetic, as an infusion for adults and as a syrup for children. It is also used to encourage menstruation. A decoction of the sap is used for mouth ulcers. In Columbia the leaves are used to encourage menstruation. In Malaysia, the leaves of P. jackii are used in the treatment of insect bites.

The root powder can be used for skin problems, as a laxative, for curing catarrhs, urinary tract diseases and diabetes.

The toxicity of the powder may cause nausea, vomiting and other organic problems when inhaled. The Indians use the fresh juice of the roots as an expectorant. The dose taken usually ranges from 3 to 8 grams of the roots diluted in a glass of water.

To induce vomiting, 8 grams are recommended, and as an expectorant 5 grams are used (for adults); (Conceiçao, 1980).

6. MAJOR CHEMICAL CONSTITUTENTS AND MEDICINAL PRODUCTS

Crystallized Emetine is produced from the dried roots. This alkaloid is used in treating amebiasis and dysentery (Hoehne, 1978). Separation of the three alkaloids contained in the root is difficult. As a result a mixture of Emetine, Cephalin and Psycotrine is often marketed under the name Emetine.

The quantity of alkaloids present depends on the age of the root. They are found in the cortex of the root, in the amylaceous region.

An active hallucinatory substance, N, N-Demethyltryptanine has been scientifically tested (Lewis et al., 1977).

7. HARVESTING, CONSERVING AND PREPARATION

In Brazil harvesting is carried out by forest workers who dig out the roots, leaving sufficient to keep the plant alive. Yields of 54-67 Kg/ha have been realized in Malaysia.

8. ECONOMICS AND MARKETING

Interest in this plant has increased during the last few decades. Nowadays the price of the alkaloid Emetine extracted from P. ipecacuanha has a high value on the international market. Initially the State of Mato Grosso was the largest producer.

Now the State of Rondonia is the main exporter (Cruz, 1982). Psychotria is also grown and marketed in India, Burma and Malaysia. Most of the exports go to England, where the alkaloids are commercialized.

In Brazil the destruction of the plant in order to obtain the roots is leading to its extinction. However its cultivation in Malaysia and Sri Lanka is very efficient.

9. SILVICS

Regeneration is usually by means of seeds, but vegetative reproduction may occur by cuttings either by the root or the stem, or even by the leaves when they fall on humid soils. It has been found most practical to intercrop Psychotria with rubber (Hevea brasiliensis) as a shade tree.

10. MAJOR DISEASES

None noted.

11. OTHER USES

None noted.

12. BIBLIOGRAPHY

Conceiçao, M (1980)	As plantas medicinais no ano 2000. Tao Livraria e editoria. 152 p.
Cruz, G.L. (1982)	Dicionário das Plantas Úteis do Brasil. Ed. Civilizaçao Brasileira S.A. Rio de Janeiro. Brasil. 599 p.
Hoehne, F.C. (1978)	Plantas e Substâncias Vegetais Tóxicas e Medicinais. Departamento de Botânico do Estado de S. Paulo. Ed. Novos Horizontes, Sao Paulo. 355 p.
Lewis, W.H. et al. (1977)	Medical Botany, Wiley & Sons, N.Y. 515 p.
Morton, J.F. (1981)	Medicinal Plants of Middle America: C.C. Thomas, Publisher (1981), Springfield, ILL. U.S.A.
Morton J.F. (1977)	Major Medicinal Plants, botany, culture and uses. C.C. Thomas, Publisher, Springfield, ILL. U.S.A.

PLATE XXVI. Psychotria ipecacuanha (Brot) Stokes

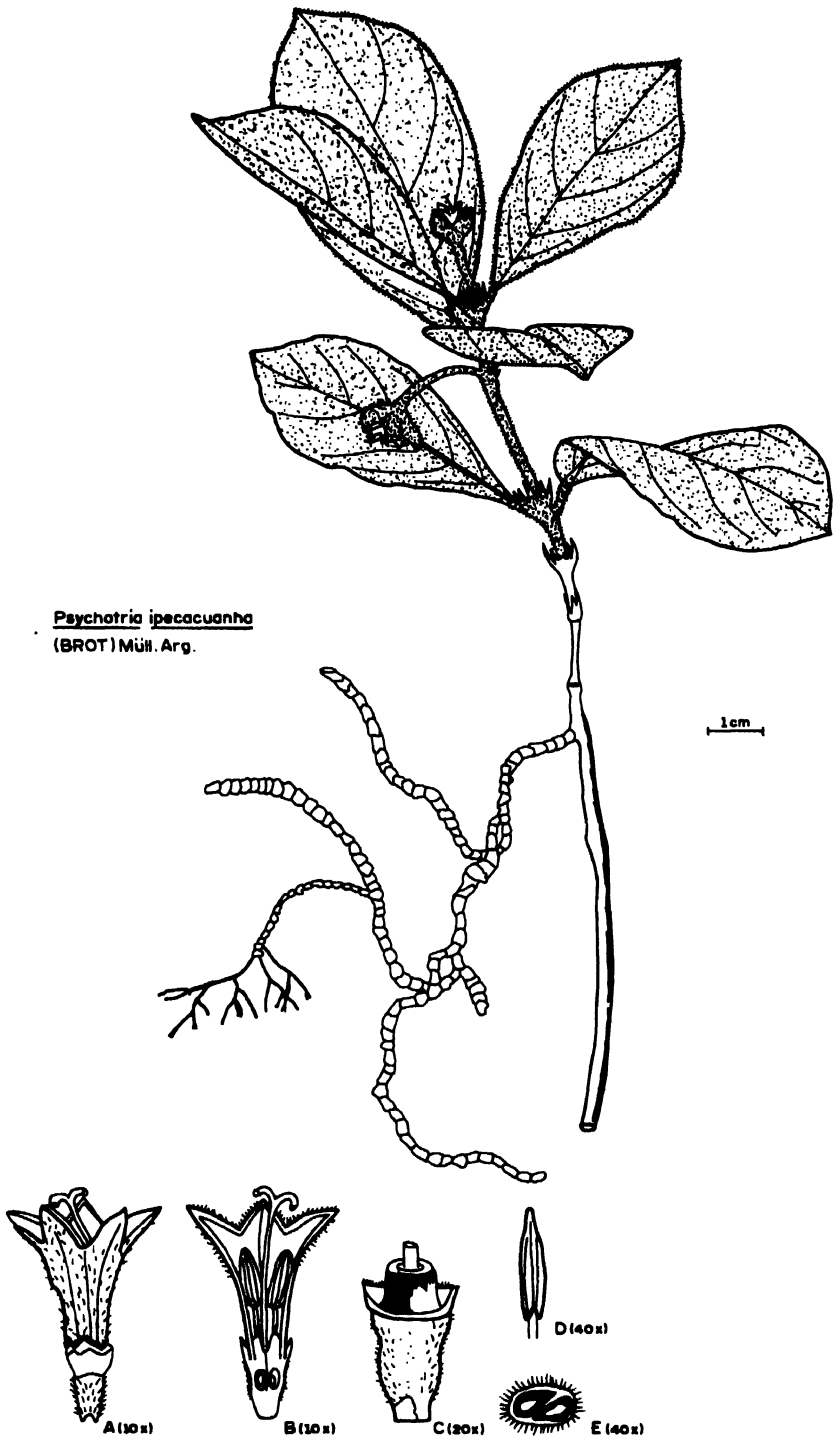
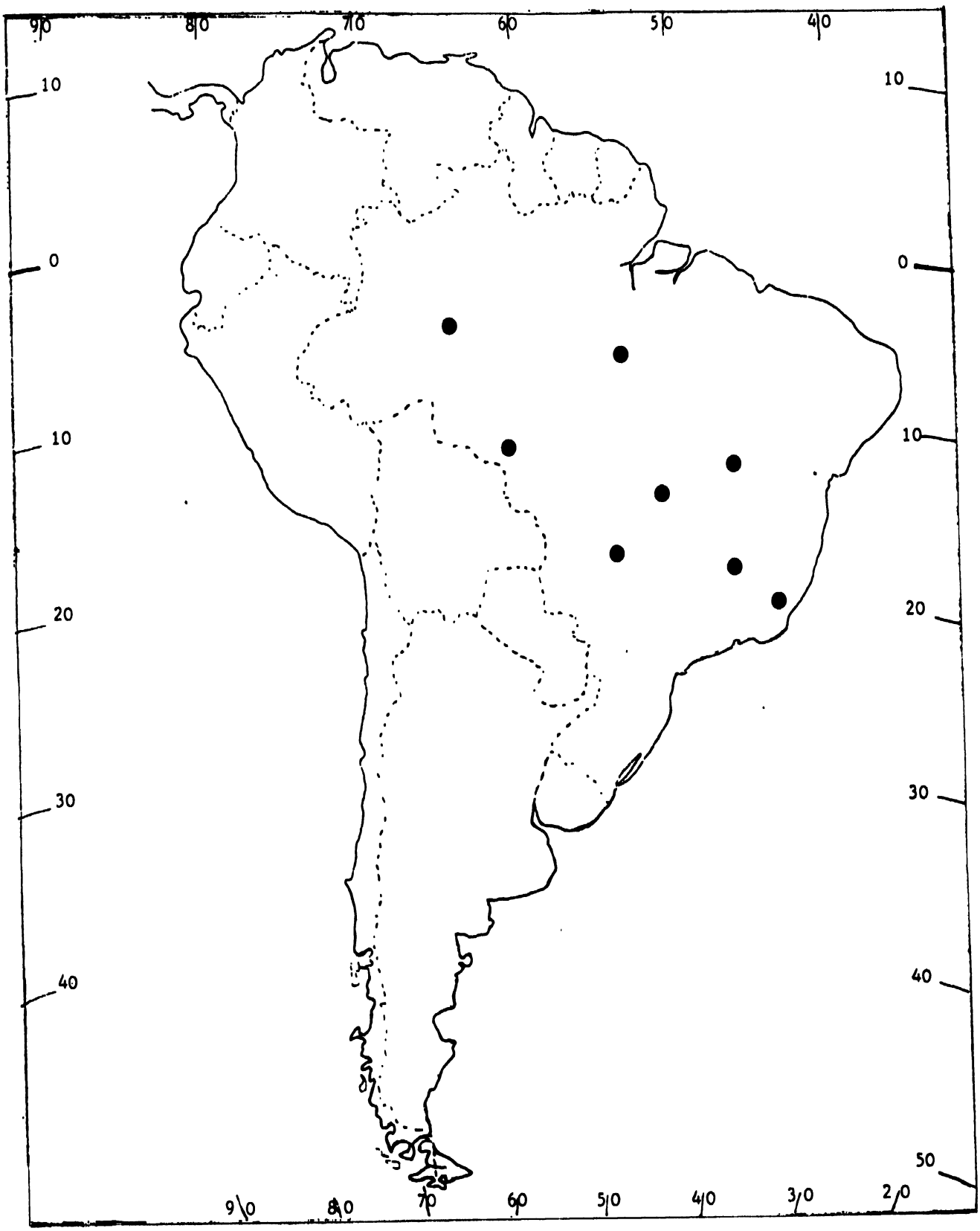


Plate XXVI. Psychotria ipecacuanha (Brot) Stokes
A. flower B. longitudinal section of flower C. detail of gynoecium
D. detail of anther E. cross section of ovary
(From Martius, C.F.P. de and Eichler, A.G. 1881-1888 - Flora Brasiliensis. Vol VI. Pars V. p. 52. Verlag Von J. Gramer. Germany)

MAP 26 - Geographic distribution of Psychotria ipecacuanha



1. BOTANICAL NAME: Quassia africana (Baill.) Baill.

SYNONYMS: Simaba africana Baill.

FAMILY: Simaroubaceae

COMMON NAMES: Ogama (Galensis), Olon (Pahoin), Bolome (Iokundu), Bundi tsi, Voanda, Kadi (Mayumbe), Yela y otomba (Equateur), Okenzu (Kitalela), Weko (Yangambi).

2. ECOLOGY AND DISTRIBUTION

A small tree of the lowland rainforest in the transition zone from evergreen to semi-deciduous forest.

In the absence of any published information the climatic parameters have been obtained by comparing the distribution of the species with the climatic diagrams of Walter and Lieth (1969). The inferred rainfall is from (100-)1500-3000mm per annum with less than two months dry season. The mean annual temperatures are 23-26.5°C. The species is unlikely to be frost tolerant.

The species occurs in Nigeria, Cameroon, Rio Muni, Gabon, Congo, Zaire and Angola (see distribution map).

3. DESCRIPTION

Shrub or small tree 1-4.5m high; bark greyish green, branches and branchlets glabrous. Leaves petiolate, alternate, compound; petiole 3-15cm long, rachis 0-15cm long, more or less narrowly constricted at the insertion of the leaflets; leaflets 1-7, opposite, sessile, lamina obovate or oblong-lanceolate, 5-20cm long, 2-8cm wide, obliquely attenuate to subrounded at the base, long-acuminate to obtuse at the apex, coriaceous to papyraceous, median nerves prominent above and below, lateral nerves up to 10 pairs, regularly anastomose. Terminal leaflet slightly larger than the lateral leaflets. Inflorescence terminal, racemose, shorter than the leaves, 12-20cm long; subsessile or peduncles up to 6cm long; bracts oblong, about 3mm long, curved, caducous; flowers hermaphrodite 5-merous, solitary or in fascicles, pedicels 3-5mm long, slender, glabrous. Calyx short, lobes 5, rounded, imbricate, later spreading; corolla larger than the calyx, petals whitish to yellowish with pinkish tinge, oblong to subspathulate, 5-10mm long, 2-3mm wide, hairy or ciliolate; stamens 10, filaments free, shortly pilose towards the base and with an internal, basal, obovate to subspathulate appendage, anthers oblong-sagitate, dehiscence longitudinal; carpels 5, opposite the petals, free, ovoid, inserted on a fleshy disc, styles 5, free at the base, uniting to form a 5-ridged column scarcely thickening into the stigma. Mericarps 1-3, tinged reddish-purple, subsessile, obovate-elliptic, slightly flattened, keeled, 20mm long, 10mm wide (Gilbert, 1958).

Flowering throughout the year, presumably also fruiting throughout the year but insufficient herbarium material with fruits available to support this.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

No established medicinal or pharmaceutical uses are known for this species, although extracts of wood of Jamaican Quassia, Picrasma excelsa, are well established as a bitter, vermifuge for threadworms, and as a treatment for pediculosis (Martindale, 1982).

5. FOLK MEDICINAL USES

The plant is known to be very bitter (Uphof, 1968). In the Congo Republic (Brazzaville) the north-west Koongo use a decoction of the bark and leaves for gastro-intestinal conditions and as a vermifuge. The root bark taken throughout the day is used to treat bronchial pneumonia. The dried and powdered root bark is also used to dress wounds. The root bark is used as an inhalant and as a febrifuge and antirheumatic. Teke women drink the juice of the leaves to treat period pains and an infusion of the root bark is drunk for gonococcal infections (Bouquet, 1969).

In Gabon infusions of the wood, leaves, and roots are taken as a tonic and febrifuge (Dalziel, 1948). A root-bark extract is used as a vermifuge and to treat bronchial conditions (Raponda-Walker and Sillans, 1961).

In Zaire similar uses are made of the plant. An infusion of the root is used to treat bronchial illness and as a febrifuge. The whole plant is used to treat syphilitic chancres (Staner and Boutique, 1937).

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Five bitter terpenoid quassinoid lactones have been isolated from Q. africana (Tresca et al., 1971). These correspond in structure to compounds previously isolated from related American plants, viz nigakilactone A, picrasine B, quassin, 14-deoxy-15(1'-methybutyryl)-brucein, and neoquassin.

Quassin is the major constitutent of Jamaican Quassia Picrasma excelsa and has insecticidal and amoebicidal properties (Casinovi et al., 1981).

Several of the quassinoids, especially those from Brucea species, have been shown to have anti-leukaemic properties. None of the constitutents of Quassia africana so far isolated are known to have this property, but 14-deoxy-15(1'methylbutyryl)-brucein D is structurally similar to the anti-leukaemic quassinoid ailanthinone (Cordell, 1977).

7. HARVESTING, CONSERVING AND PREPARATION

The plant does not appear to be cultivated and is used fresh. Details of preparations are given in (4) above.

8. ECONOMICS AND MARKETING

Appear to have no market potential at present.

9. SILVICS

No information. Presumably reproduced from seed.

10. MAJOR DISEASES

None reported.

11. OTHER USES

An ointment is made of the root bark with palm oil for dealing with lice (Staner and Boutique, 1937). Extracts of Quassia with soft soapwood as an insecticide in horticulture (Oliver, 1960).

12. BIBLIOGRAPHY

Bouquet, A. (1969) Féticheurs et médicines traditionnelles du Congo (Brazzaville), Mém. O.R.S.T.O.M., 400.

Casinovi, C.G., Fardella, G., Gandolini, G. and Burinato, C. (1981) Proprietà anti-amebiche di alcuni derivati dell'ailantone e della quassina. Farmaco, Sci. Ed., 36, 116-122.

Cordell, G.A. (1977) In H. Wagner and P. Wolff (eds.), New natural products and plant drugs with pharmacological, biological or therapeutic activity, Berlin: Springer, 60.

Dalziel, J.M. (1937) Useful plants of West Tropical Africa, London: Crown Agents, 314.

Gilbert, G. (1958) Simaroubaceae in Flore du Congo Belge et du Rwanda-Urundi 7:119-131. Bruxelles: I.N.E.A.C.

Martindale, W. (1982) The Extra Pharmacopoeia 28th ed., J.E.F. Reynolds (ed.), London: Pharmaceutical Press, 318.

Raponda-Walker, A. and Sillans, R. (1961) Les plantes utiles du Gabon, Paris: Paul Lechevalier, 400.

Staner, P. and Boutique, R. (1937) Plantes médicinales indigènes du Congo Belge, Bruxelles: M. Hayez, 87.

Tresca, J.P., Alais, L. and Polonsky, J. (1971) Constituants amers du Quassia africana Baill. (Simarubacées). Simalikalactones A,B,C,D, et simalikahémiacétal A. Compt. Rend. Acad. Sci., Paris sér. C, 273, 601-604.

Uphof, T.J.C. (1968) Dictionary of economic plants, 2nd ed., Lehre: Cromer, 438.

Walter, H. and Lieth, H. (1969) Klimadiagramm Weltatlas. Jena: Fischer.

PLATE XXVII. Quassia africana (Baill.) Baill.

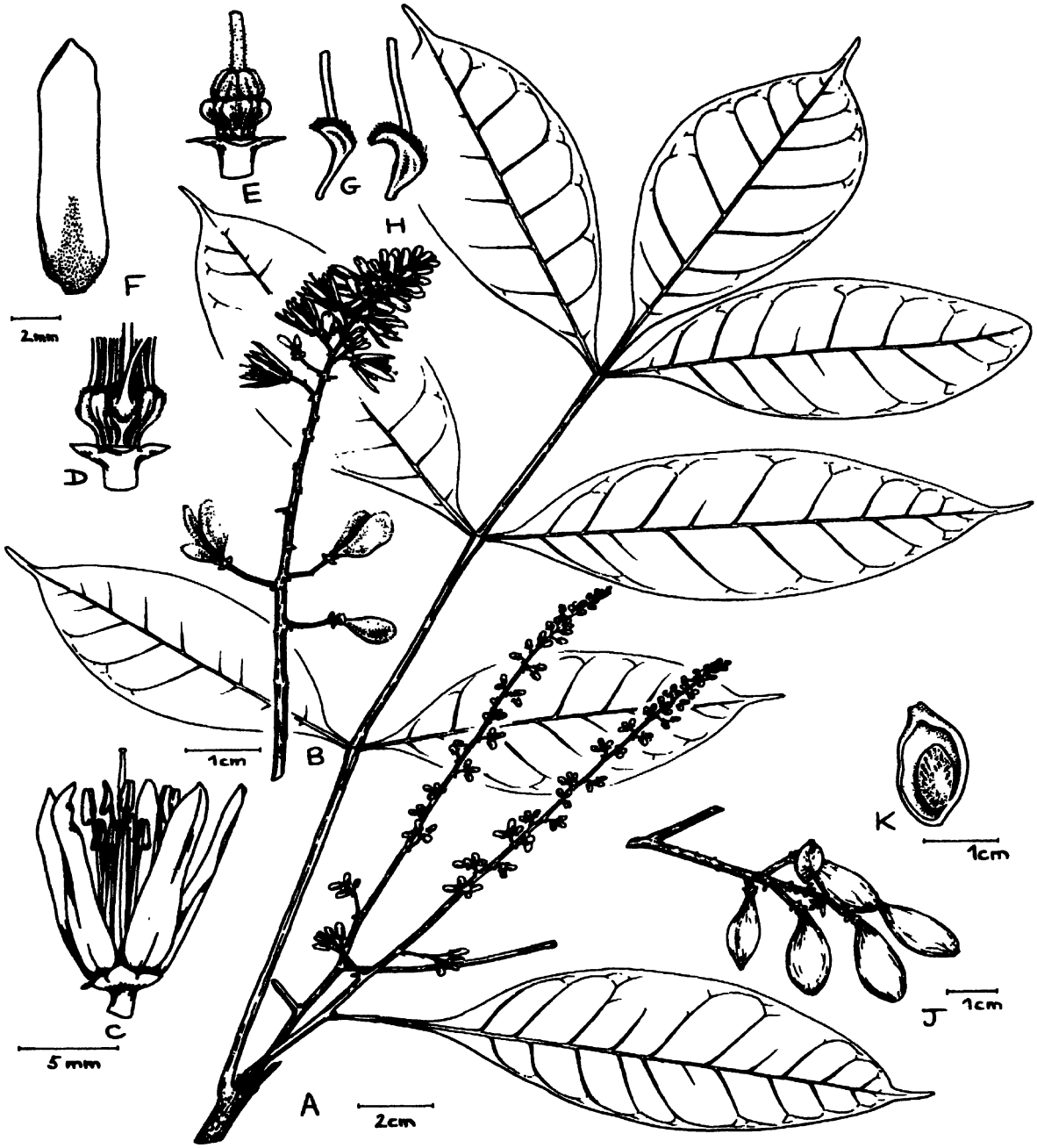
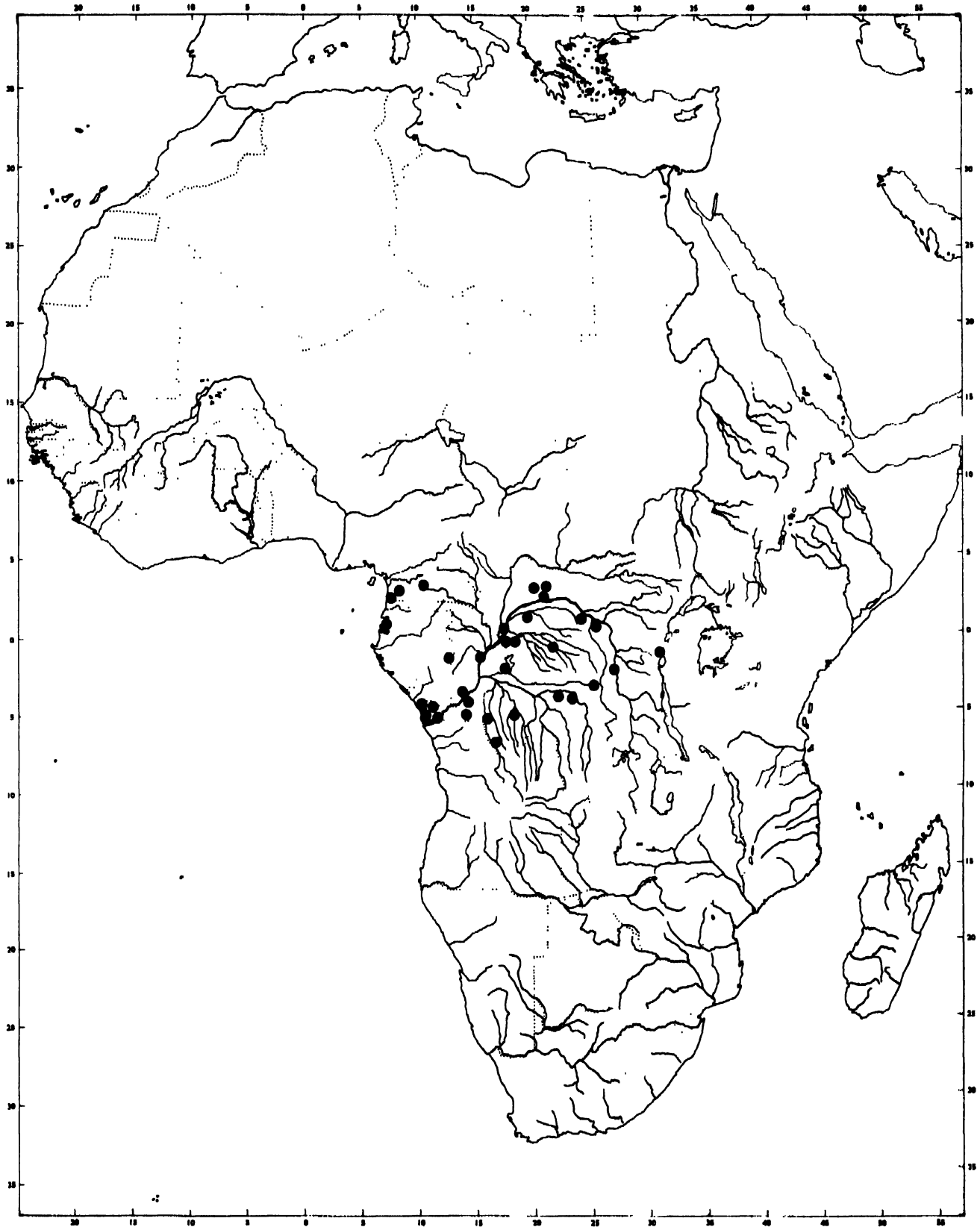


Plate XXVII. Quassia africana (Baill.) Baill.

		Bar scale
A.	habit	2 cm
B.	inflorescence	1 cm
C.	flower	5 cm
D.	flower with petals removed	2 mm
E.	pistil	2 mm
F.	petal	2 mm
G.	inner anther base	2 mm
H.	outer anther base	2 mm
J.	fruits	1 cm
K.	dissected fruit and seed	1 cm

MAP 27 - Geographic distribution of Quassia africana



1. BOTANICAL NAME: Rauvolfia caffra Sond.

SYNONYMS: Rauvolfia natalensis Sond.
Rauvolfia inebrians K. Schum.
Rauvolfia ochrosioides K. Schum.
Rauvolfia goetzi Stapf
Rauvolfia obliquinervis Stapf

FAMILY: Apocynaceae

COMMON NAMES: Quinine Tree; Mwembemwitu, Mkufi (Kiswahili), Msesewe, Mseseve (Kimeru, Kichagga), Mweti (Kisambaa), Muveliveli (Kihehe), Mlolo (Kividunda), Oljabokalyan (Kimassai), Mlengwelengwe (Kinguu), Njavokalia oltawakalian (Kiarusha), Mtwentwe (Kibende), Mkongo (Kigogo), Msumai (Kirangi), Mwerere (Kikuyu), Mbaribari (Taveta), Mutu (Meru), Mwimbi (Bemba,Kaonde,Tonga), Mutoto (Kaonde,Lunda),Mutochi (Lunda), Muyesani, Mpambamvula, Msabua, Mvumbamvula, Mwimbe (Nyanja).

2. ECOLOGY AND DISTRIBUTION

Rauvolfia caffra is widely distributed in the riverine Brachystegia woodland, lowland rain forest, dry montane forest and montane rain forest of the highlands of eastern and southern Africa. It grows on loamy sands to sandy clay loam soils of mainly volcanic origin at altitudes between 500 and 2100m, in areas receiving an annual rainfall between 500 to over 1270mm.

It occurs in Zaire, Uganda, Kenya, Tanzania, Mozambique, Malawi, Zambia, Zimbabwe, Transvaal, Natal, Cape and Zululand (see distribution map).

3. DESCRIPTION

A much-branched tree to 35m high, 1.5m or more in diameter; bole straight, slightly buttressed, bark light brown or greyish-white with irregular fissures; slash cream, exuding a bitter white latex; crown dense. Leaves in crowded whorls, simple, stipules absent; blade oblanceolate to linear-oblanceolate, 6-32cm long, 1.5-7cm wide, apex obtuse to acute of subacuminate, base cuneate, margins entire, glabrous, shiny green above, paler below, lateral nerves 18-30 pairs; petiole 0.5-6cm long. Inflorescence a terminal compound umbel, peduncle 2-6cm long, bracts minute; flowers bisexual, 5-merous, pedicels 1mm long. Calyx cup-shaped, 1mm long, 5-toothed or lobed; corolla salver-shaped, white, tube 3-4.5mm long, lobes ovate, 1mm long, mouth filled with whitish hairs; stamens 5, inserted above the middle; ovary of 2 more-or-less united carpels, often only one developing. Fruit a subglobose to obovoid drupe, smooth and green at first, becoming wrinkled and blackish-purple, 1-1.5cm long, 2cm in diameter if 2-seeded; seeds 1 or 2, white, ovoid-compressed, endosperm fleshy.

In Tanzania flowering occurs during the long rains, extending into the dry season up to the onset of the short rains, i.e. March to November; fruit ripens during the dry season extending into the short rainy season up to the long dry season, i.e. from February to November. It takes about 9-10 months between fertilization of the flower and ripening of the fruit.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Chhdra (Pers. Comm.) reports that the pharmacological studies of the plant have shown it to be central depressant. It has sedative action and an antihypertensive effect accompanied by brachycardia. According to Watt and Breyer-Brandwijk (1962) a bitter alkaloid which is isolated from the plant has an antimalarial reputation.

R. caffra alkaloid (reserpine) exerts important effects on behaviour and on autonomic functions; it has been very useful in the treatment of hypertension and psychoses.

5. FOLK MEDICINAL USES

The root of the plant, R. caffra is traditionally used for treating insomnia and insecurity. Kokwaro (1976) reports that a bark decoction is drunk as a medicine for general body swellings, rheumatism and pneumonia. Watt and Breyer-Brandwijk (1962) observed that the stem and root bark are used as an ascaricide and the powdered unopened inflorescence as a local application to sores on the legs.

The root juice, mixed with honey, is applied to fractures. The bark has been used as an astringent and as a colic remedy. Harjula (1980) observed that the root bark is dried and ground or pounded while fresh and an infusion prepared for remedy of roundworms and tapeworm.

R. caffra acts as a purgative and/or an emetic. The R. caffra bark is used as a cure for coughs, stitch and toothache.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Chhdra (Pers. Comm.) observed that a chemical analysis of R. caffra has shown that it contains ten alkaloids, some of these are ajmaline, raucaffricine, rescinnamine, reserpine, serpentine, yohimbine, etc.

Harjula (1980) reports that the plant contains many alkaloids e.g. reserpine, rauwolfine, rescinnamine. Watt and Breyer-Brandwijk (1962) report that the bark yields 0.6 to 0.7 per cent of alkaloids.

Other estimates give 0.8 per cent from the root, 3.0 per cent from the root bark and 1.2 per cent from the stem bark. A crystalline alkaloid rauvolfine and bitter alkaloid have been isolated from R. caffra.

7. HARVESTING, CONSERVING AND PREPARATION

The bark is obtained from the stem, dried, pounded and the powder obtained is preserved in bottles. The powder is mixed with water to form an infusion which is used for various remedies. The root is excavated, washed, cut into pieces and boiled to form a decoction. Alternatively the root is debarked, the bark dried and then ground to form the powder which is used to make an infusion. The leaves are plucked, pounded and boiled to make a decoction and normally are not stored.

8. ECONOMICS AND MARKETING

There have been no efforts to carry out economic studies on R. caffra. The plant is collected free of charge and very little income is collected. However, with the isolation of the effective ingredients, there is a possibility of raising it on a large scale in plantations and thus deriving some income from it.

9. SILVICS

R. caffra regenerates naturally from coppice, suckers and seed. Root suckers are produced when the root is wounded. The seed germinates after staying on the forest floor for quite a long time.

The tree is a shade demander especially when very young. However, as the tree grows older, its light requirement changes. The old trees do not tolerate shade.

Artificial regeneration of R. caffra has been tried in Lushoto. Wildings were picked from the forest, potted in the nursery and after 8 months were planted out in an arboretum plot. However, all the plants died the following growing season, the cause of death is not known.

With suitable seed-pretreatment the species could be raised in the nursery and planted in the field. However, some means of overcoming die-back problems should be sought.

10. MAJOR DISEASES

None specified.

11. OTHER USES

The tree is a source of timber and fuel.

The root and stem bark is added by the Chagga to an alcoholic beverage made from banana to increase the potency of the drink.

It is an important species in bee-keeping.

It is used as a shade tree in coffee plantations and the leaves are used by circumcised boys to sleep on when their wounds are still fresh.

12. BIBLIOGRAPHY

Harjula, H. (1980) Mirau and his Practice. A study of the Enthnomedicinal Repertoire of a Tanzanian Herbalist. Tri-Med. Book. London. 223 p.

Kokwaro, J.O. (1976) Medicinal Plants of East Africa. E.A. Literature Bureau Nairobi.

Morgan, W.T.W. (1972) East Africa: its peoples and resources. Oxford University Press. Nairobi. 312 p.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa. E. & S. Livingstone Ltd. London. 1455p.

PLATE XXVIII. Rauvolfia caffra Sond.

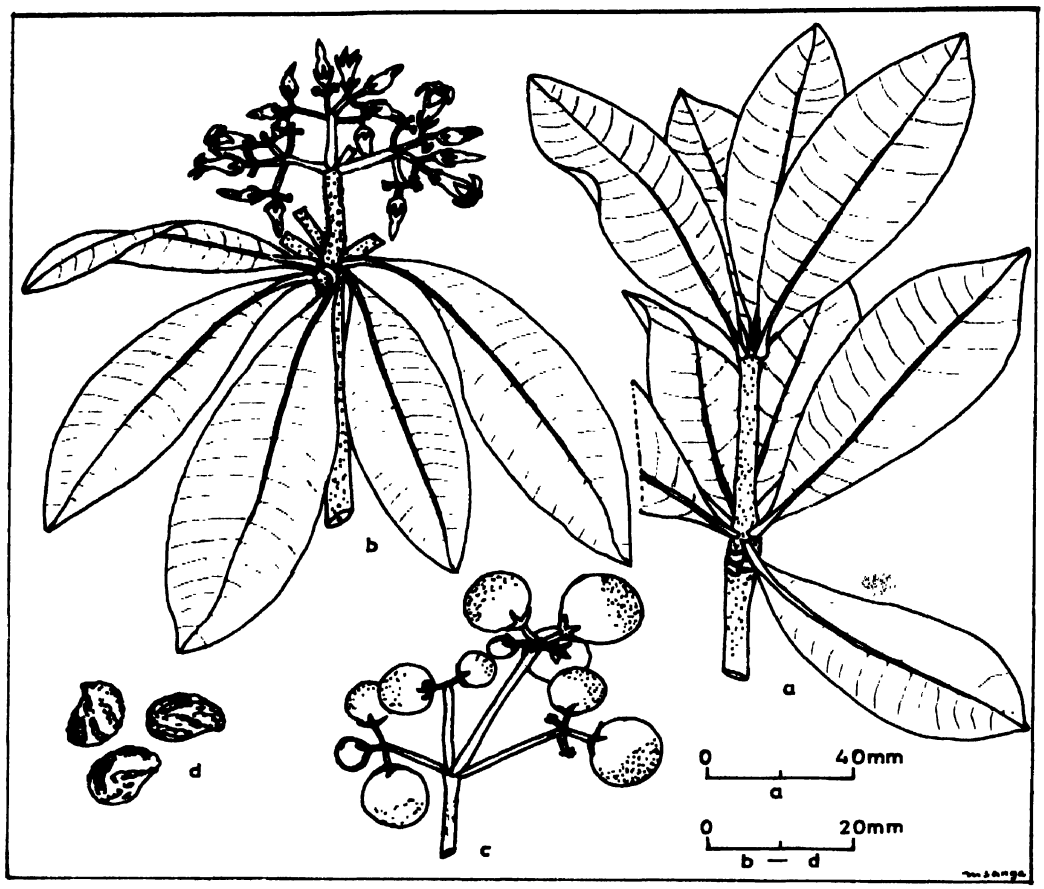


Plate XXVIII. Rauvolfia caffra Sond.

a) branchlet b) branchlet bearing flowerbuds and flowers c) cluster of young fruits d) seeds

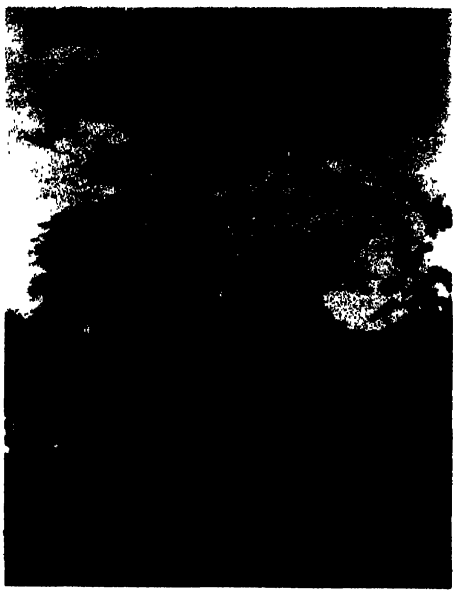
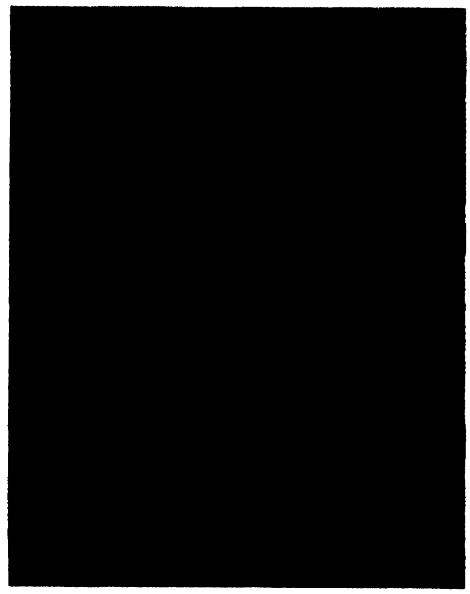


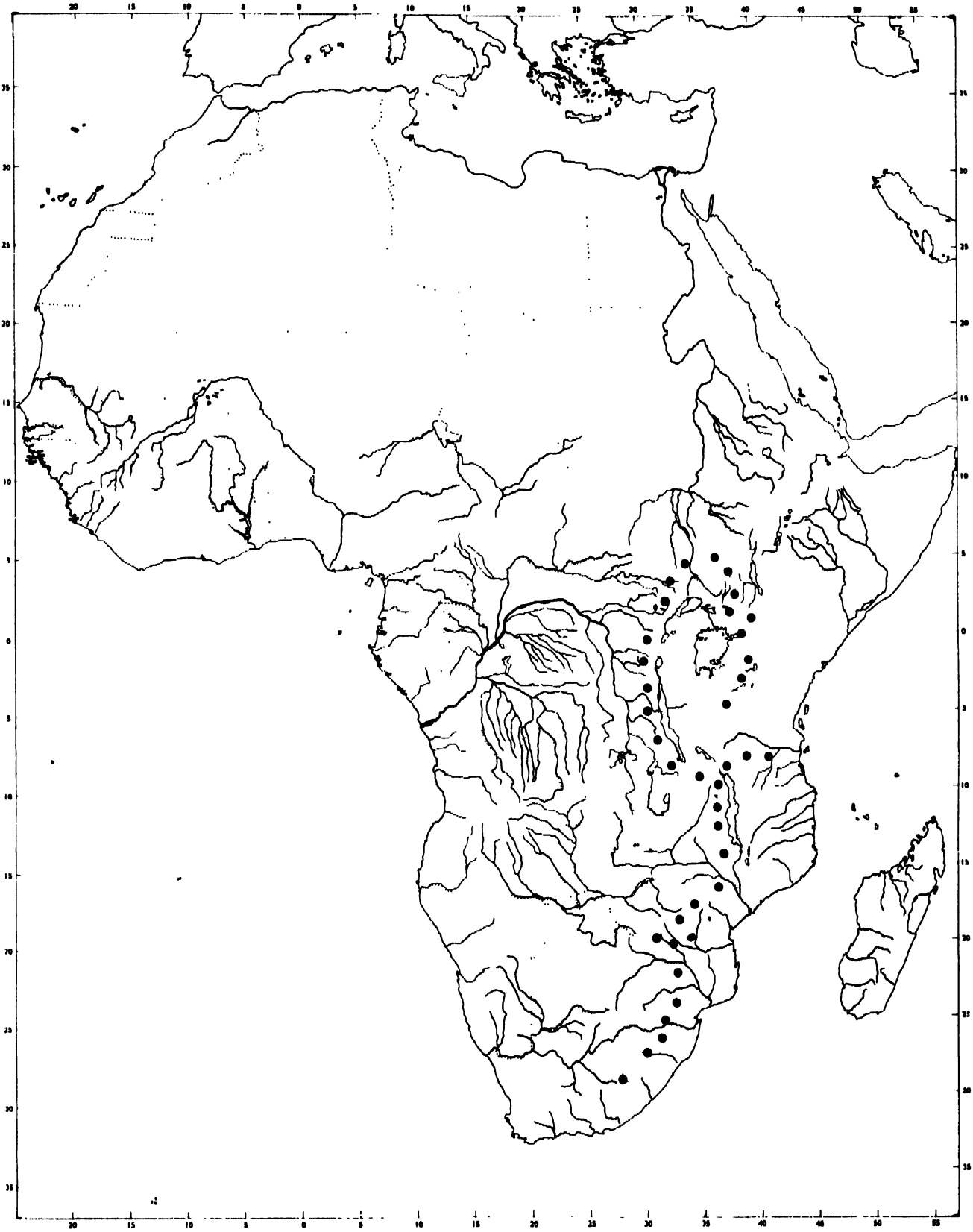
Plate XXVIII-1 Tree at Lushoto, Tanga - May, 1983 (Photo Ruffo)

Plate XXVIII - 2

branchlet bearing flowerbuds and flowers (Photo Ruffo)



MAP 28 - Geographic distribution of Rauvolfia caffra



1. BOTANICAL NAME: Rauvolfia vomitoria Afzel.

SYNONYMS: Hylacium owariense P. Beauv.
Rauvolfia senegambia DC.

FAMILY: Apocynaceae

COMMON NAMES: Kakapenpen, Penpen (Ashanti, Twi, Wassaw), Baka egbe, Ngbe ngbe (Anyi), Susuidua (Wassaw); Asofeyeje (Yoruba), Akata (Bini), Akanta (Ibo), Uto enyin (Efik).

2. ECOLOGY AND DISTRIBUTION

In Nigeria Rauvolfia vomitoria is found in moist lowland forest, rare in dry forest. It is common in secondary forest in Ghana.

It is widespread in tropical Africa, occurring in Senegal, Mali, Guinea, Guinea Bissau, Sierra Leone, Liberia, Ghana, Dahomey, Nigeria, Cameroun, S. Tomé, Gabon, Zaire, Sudan, Uganda and Tanzania (see distribution map).

3. DESCRIPTION

Erect shrub or small tree to 15m high, bark grey; slash pale brown, exuding a bitter-tasting white latex; branchlets markedly whorled, angular, covered with white lenticels. Leaves whorled, simple, stipules absent; petiole 8-25cm long, shallowly grooved above; blade elliptic to slightly oblanceolate, 10-18.5cm long, 3.5-7cm wide, apex usually gradually and shortly acuminate, base cuneate, margins entire, papyraceous to coriaceous, upper surface shiny-green, dull medium green below, midrib impressed above, major laterial veins 8-16 pairs, more prominent below. Inflorescence puberulous, up to 12cm long, rachis stout, up to 7cm long, repeatedly branching; in whorls with flowers in 3s at the end of the ultimate branches. Sepals 5, ovate, c.2mm long, puberulous, often deflexed in fruit; corolla creamy-white, up to 1cm long, lobes small. Fruit red, solitary or paired, ovoid/ drupe, c.6mm in diameter.

In Nigeria flowering January to May and July, fruiting April to November.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The plant is a source of reserpine, used as hypotensives and CNS sedatives (Trease and Evans, 1978; Nwaiwu, 1982).

5. FOLK MEDICINAL USES

One tablespoonful of the root and stem bark infusion mixed with Capsicum spp. taken 3 times daily cures malaria fever. Overdose is reported to be very dangerous.

Three or four spoonfuls of the infusion (in hot water) of two or three leaves of R. vomitoria will induce vomiting and violent purgation as a treatment for constipation or indigestion (Dalziel, 1937).

An infusion of root bark mixed with spices cures jaundice and gastro-intestinal conditions.

Leaves of R. vomitoria are boiled with seven fruits of Xylopia aethiopica to treat convulsions in children. The resulting solution is given to the child to drink and for bathing.

A decoction is applied externally to treat ascites. Sixty-one leaves of R. vomitoria, sixty-one leaves of Spondia monbin and seven fruits of Xylopia aethiopica are boiled together, the decoction is then used for bathing the patient.

To induce labour and safe delivery in women 201 leaves of R. vomitoria, leaves of Indigofera macrophylla, the whole plant of Olyra latifolia and leaves of Cajanus cajan are all boiled; the decoction when allowed to cool is drunk as a remedy against smallpox.

Root bark of R. vomitoria, ripe fruits of Piper guineense, seeds of Parkia clappertoniana (locust bean) are cooked with snail. The soup so prepared is taken as a cure for rheumatism.

A tablespoonful of powdered root bark mixed with local gin is given three times daily as a cure for mental disorder. Latex from the leaves is used to treat general skin disease (Lewis and Elvin-Lewis, 1977).

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Chemical constituents in the roots include rescinnamine, and alkaloids such as reserpoxidine, seredine, ajmaline and yohimbine.

From the fruits, the following alkaloids have been isolated: tetrahydroalstonine, rauvomitine, yohimbine and ajmaline - 17 - O - (3,4, 5 trimethoxybenzoic acid (Iwu, 1983).

Amer and Court (1981) reported 19 alkaloids from leaves of R. vomitoria. These include E-seco indole sarpagan, picrinine, akuammiline, heteroyohimbine oxidole, Yohimbine and indolenine types. The most abundant were tetrahydroalstonine, aricine, isoreserpiline, carapanaubine, reserpiline and rauvoxine.

Puri and Talala (1974) reported steroid - serpostero and some alkaloids.

7. HARVESTING, CONSERVING AND PREPARATION

The roots of the plant are harvested and careless exploitation can result in depopulation of the species. The root bark, bark, leaves and fruit are all used for local medicines. The roots and root bark are the main source of extractives such as reserpine, rescinnamine, ajmaline and ajmalicine (UNCTAD/GATT).

8. ECONOMICS AND MARKETING

R. vomitoria is one of the most commercially important of the 86 Rauvolfia species occurring in tropical and sub-tropical areas. The cost per kg c.i.f. of cut Rauvolfia root was reported to be Din. 8.50 in June 1986 and for Reserpine 0.55/g for 100g lots in the UK (UNCTAD/GATT).

There are 22 UN registered sources of supply of reserpine in 8 Western European and 2 Eastern European countries,7 of these sources are actually processors of raw material and the remainder are brokers or wholesalers (UNIDO, 1984). This gives some indication of the importance of the drug and its raw material.

The largest producers of R. vomitaria are Zaire, Mozambique and Rwanda. The demand for Rauvolfia-based products appears to be on the decline and unless markets are expanded the prospects are not good (UNCTAD/GATT).

9. SILVICS

Rauvolfia vomitoria is not usually cultivated, it is collected as a wild plant. It is said to be hardier than R. serpentina, coppices readily and is capable of growing in poor soils. It appears likely that the species could be propagated from seed.

10. MAJOR DISEASES

The plant is the wild host of Collar Crack in cocoa.

11. OTHER USES

The tree is suitable for live fencing and is common as an ornamental tree (Dalziel, 1937). R. vomitoria root fed to cattle at levels of 5,25 and 125mg/head/day have been found to improve growth rate and food efficiency (Sherman et al., 1958).

The seeds are used for making beads. The wood is fine-grained, whitish, turning red with age. The 4-forked twigs are used as swizzle sticks and the larger branches for stirring indigo. The plant contains a bast fibre (Irvine, 1961).

12. BIBLIOGRAPHY

Amer, M.M. and Court, W.E. (1981) Leaf alkaloids of Rauvolfia vomitoria. Phytochemistry 19,8: 1833.

Dalziel, J.M. (1937) The Useful Plants of West Tropical Africa. London: Crown Agents.

Irvine, F.R. (1961) Woody Plants of Ghana. London: Oxford University Press.

Lewis, W.H. and Elvis-Lewis, M.P.F. (1977) Medical Botany New York: Wiley Interscience.

Nwaiwu, J. (1982) Indigenous drugs and pharmacy practice. Journal of Pharmacy. 13,6: 11.

Puri, S.G. and Talata, D. (1964) A survey of some plants used in native medicine of West Africa of interest to India. Paper presented at a Symposium on Recent Advances in the Development, Production and Utilisation of Medicinal and Aromatic Plants. pp. 35.

Sherman, W.C., Hale, W.H., Reynolds, W.M. and Luthrer, H.G. (1958) Nutritional studies of hydroxyzine and Rauvolfia in cattle and lambs. Proceedings of the Society for Experimental Biology and Medicine. 98:91.

Trease, G.E. and Evans, W.C. (1978) Pharmacology. ed.11. London: Baillière Tindall.

UNCTAD/GATT (1982) International Trade Centre: Markets for Selected Medicinal plants and their derivatives, genera, pp. 113-118.

UNIDO (1984) Directory of sources of supply of Pharmaceutical chemicals, their intermediates and some Raw Materials included in the Pharmaceutical Industry, Budapest, Hungary, 21-25 November, 1983.

PLATE XXIX. Rauvolfia vomitoria Afzel

Plate XXIX. Rauvolfia vomitoria Afzel.

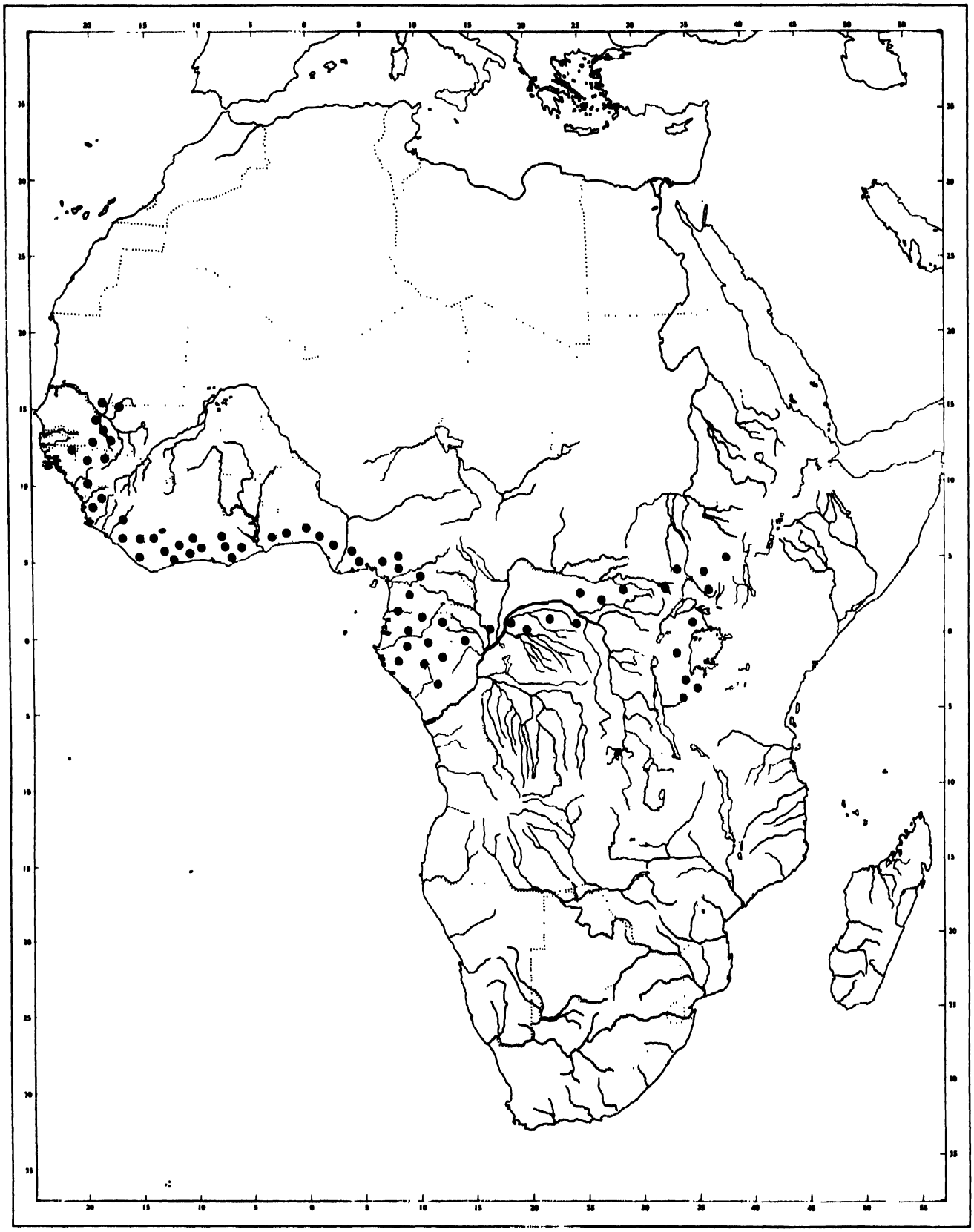
A. flowering shoot B. fruit-bearing shoot C. flower

(Source Keay et al., 1964)

Plate XXIX - 1

Branch of Rauvolfia vomitoria

MAP 29 - Geographic distribution of Rauvolfia vomitoria



1. BOTANICAL NAME: Sclerocarya birrea (A.Rich.)Hochst.

SYNONYMS: Spondias birrea A.Rich.
Poupartia birrea (A.Rich.)Aubrév.

FAMILY: Anacardiacea

COMMON NAMES: N'guna (Bambara), Hedi (Peul), Diney (Sonrai), Tuwila (Tamacheck); Mu-mugga (Dagbani), Burunogo (Issala), Nanogba (Nankani), Birr Wolof), Dania (Hausa),Katetalam (Sebei) Didissa (Boran).

2. ECOLOGY AND DISTRIBUTION

Sclerocarya birrea occurs in the drier savannas of northern tropical Africa, usually on sandy soils, sometimes on lateritic or stony soils. The rainfall may be as little as 300mm per annum; in higher rainfall areas, 450-800mm the tree is often conspicuous as an emergent through the canopy of the neighbouring savanna trees.

It occurs in Senegal, Mali, Guinea Bissau, Gambia, Ivory Coast, Burkina Faso, Ghana, Togo, Dahomey, Niger, Nigeria, Chad, Sudan, Ethiopia, Uganda and northern Kenya (see Map).

3. DESCRIPTION

Deciduous tree 8-15m high, up to 1m in diameter; bark light grey, finely fissured and flaking in small or large scales; slash orange pink with green edges, fibrous, exuding a nearly colourless gum. Leaves alternate, tufted at the ends of the branchlets, compound, stipules absent; rachis 15-30cm long; leaflets opposite or subopposite, 5-10 pairs with an odd terminal leaflet, elliptic to obovate, 2-5cm long, 1-2.5cm wide, apex more or less rounded but with a very short, sharp tip, base cuneate, margins usually entire, dentate on young and coppice regrowth, glaucous, pale green, venation obscure, subsessile. Inflorescence a spike-like raceme, up to 10cm long; flowers precocious, appearing before the leaves, dioecious, greenish-white or reddish; subtending bracts reddish, broadly ovate, conspicuous at first. Male spike erect, terminal, 5-8cm long; stamens 12 or more. Female flowers 2 or 3 together, pedicels stout, 2-2.5cm long, sepals purple-red, free; petals recurved, green with purple-red tips. Fruit a pale yellow drupe, subglobose, 3-4cm long, 2.5-3.5cm in diameter; seeds 2-3, obclavate, compressed, testa brownish, papyraceous. Flowers appear before the leaves late in the dry season.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None known so far.

5. FOLK MEDICINAL USES

The plant can be used to regulate glycaemia and it improves carbohydrate consumption at muscle level. A decoction of the leaves or bark is used in the treatment of sugar diabetes; decoctions of leaves, bark and roots counter snake-bite; infusions of bark are used to wash infants in cases of malaria or inflammation; mixed with soda it is used to alleviate dysentery (Von Maydell, 1983).

6. MAJOR CHEMICAL CONSITUTENTS AND MEDICINAL PRODUCTS

The parts most used are the leaves and the bark, in particular the bark of the roots. The leaves and the bark contain catechic and gallic tannins and flavonoids. The pulp and kernels of the fruit contain glucides, amino-acids (glutamic and arginine acid), and lipids (oleic, myristic and stearic acid).

7. HARVESTING, CONSERVING AND PREPARATION

Harvesting is mainly from May to December. After harvesting, the leaves should be dried in the shade in a well-ventilated place, at a temperature not above 40°C.

Leaf powder should be conserved away from light, in hermetically sealed containers. It is inadvisable to use powder which has been conserved for more than one year.

The bark is not very thick and its epidermis is easily detached.

8. ECONOMICS AND MARKETING

Products collected and marketed locally.

9. SILVICS

400 seeds per kg, soak the seeds overnight before sowing. Propagation possible by seed, cuttings or root-cuttings.

10. MAJOR DISEASES

None known.

11. OTHER USES

The pulp of the fruit which has an agreeable acid taste is edible and can be used to make an intoxicating drink. The fruit and kernels of the seeds are oily and edible yielding 60l of oil per ton of fruit. Wood soft, non-durable, easy to carve, turn and work. When large enough the wood from the trunk is used for mortars, pestles and bowls. The shoots, though mildly toxic, are collected as cattle feed in the dry season (Von Maydell, 1983).

12. BIBLIOGRAPHY

Irvine, F.R. (1961) Woody Plants of Ghana with special references to their uses; Oxford University Press.

Von Maydell, H.J. (1983) Arbres et arbustes du Sahel. Leurs caractéristiques et leurs utilisations. G.T.Z., Eschborn.

Dale, I.R. and Greenway, P.J. (1961) "Kenya trees and shrubs" Government of Kenya and Hatchards. 187 Piccadilly, London W.I.

PLATE XXX. Sclerocarya birrea (A. Rich.) Hochst.

Sclerocarya birrea (A. Rich.) Hochst. (Anacardiaceae).
A, leaflet showing venation. B, habit. C, flower. D, cross-section of ovary. E, fruit.

Plate XXX. Sclerocarya birrea (A. Rich.) Hochst.

A. leaflet showing venation B. habit C. flower
D. cross section of ovary E. fruit

(After Irvine, F.R., 1961. Woody Plants of Ghana)

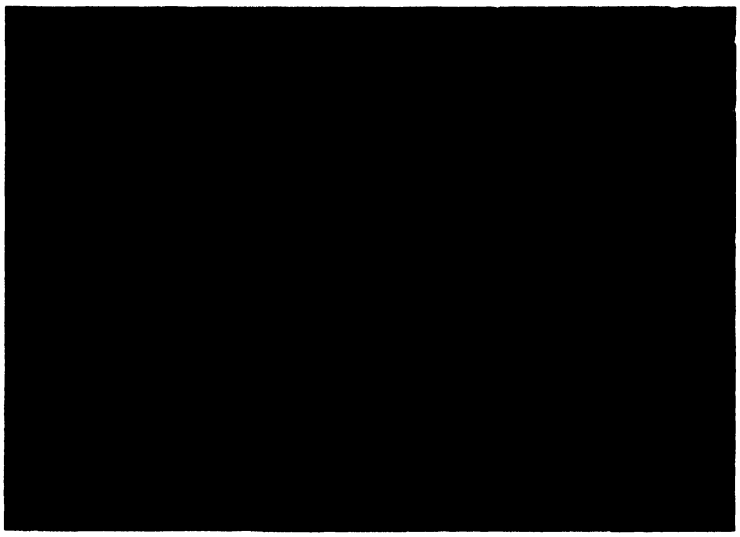
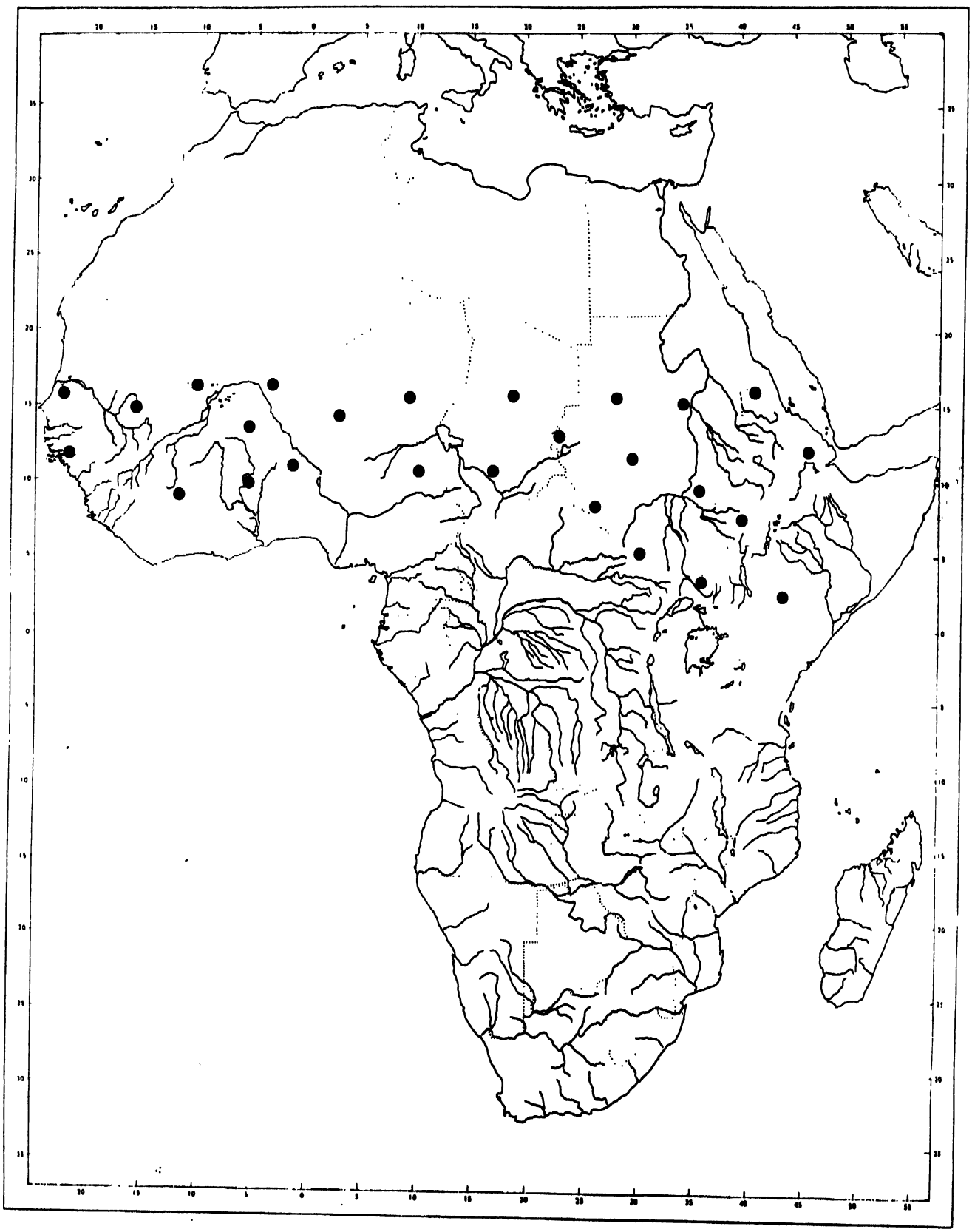


Plate XXX-1

Sclerocarya birrea

young plant

MAP 30 - Geographic distribution of Scerocarya birrea



1. BOTANICAL NAME: Solanum incanum L.

SYNONYMS: Solanum sanctum L.
Solanum esculentum Drège
Solanum subexarmatum Dunal
Solanum delagoense Dunal
Solanum beniense De Wild.

FAMILY: Solanaceae

COMMON NAMES: Intobo, Umucucu (Rwanda); Ndula (Kihene), Bwantula, Bwanhula, Mtula (Mizaramo), Ntufululu (Kibende), Mnyanya-mvitu (Kirufiji), Mtula (Kisambaa), Nangali (Kifiome), Mdangu (Kipare), Matulu (Kisukuma), Indulele (Ki-arusha), Mtobotobo (Kikerewe), Mtobolo (Kijita), Mtunguja, Mndulele (Kiswahili), Mdulamu, Mtulantu (Kinyamwezi).

2. ECOLOGY AND DISTRIBUTION

Solanum incanum is a widespread shrubby perennial occurring on a variety of soils from sea level to about 2200m or more in semi-arid areas receiving c.250mm rainfall to high rainfall savannas receiving over 2000mm annual rainfall.

The species is widely distributed in tropical Africa and has been recorded from Mali, Senegal, Guinea Bissau, Ghana, Togo, Dahomey, Nigeria, Cameroon, Zaire, Rwanda, Burundi, Chad, Sudan, Ethiopia, Somalia, Uganda, Kenya, Tanzania, Mozambique, Malawi, Zambia, Zimbabwe, Botswana, Angola, Namibia and South Africa (see distribution map).

3. DESCRIPTION

A perennial shrubby herb 1-3m high; stem and branchlets with stout prickles, densely grey-ochraceous stellate tomentose. Leaves alternate, simple, stipules absent; blade ovate to ovate-elliptic, 2.5-12cm long, 2.5-8cm wide, apex rounded or acute, base truncate to subcordate, margins repand-sinuate, with 2-4 rounded 'lobes' on each side, greenish-grey tomentose above, densely grey tomentose below, sometimes prickles present on the midrib and nerves below. Inflorescence of more or less lateral few-flowered cymes or flowers solitary; flowers hermaphrodite, 5-merous. Calyx cup-shaped, 5-lobed; corolla purple-violet or white, rotate, 2.5cm in diameter; stamens 5; ovary hirsute, style about 1cm long. Fruit a yellowish berry 2-4cm in diameter; seeds numerous, compressed-ovoid, 3mm long, 2mm wide.

A short-lived perennial, which in Tanzania may survive up to 3 years, sometimes for only one year. Flowering and fruiting continues throughout the year.

4. ESTABLISHEED MODERN PHARMACEUTICAL USES

Biological studies have indicated that the S. incanum plant could be used for treating cutaneous mycotic infections and other pathological conditions. A potent antimicrobial substance with phosphorylated structure similar to the purine ademine stops the growth of gram positive and gram negative bacteria, yeast, dermatophytes, and some agricultural pathogens. (Chhabra, Pers. Comm.) S. incanum contains solanine which has a direct effect on the mucous membrane of the alimentary tract and when absorbed into the blood stream brings about haemolysis of the red cells.

It also produces stimulation of the central nervous system followed by depression and even paralysis of the respiratory or motor centres and,in large doses, cardiac arrest.

5. FOLK MEDICINAL USES

A decoction of the roots is used for abdominal pains, dyspepsia, fever, stomach-ache and indigestion. The roots can be used for tooth-ache by scrubbing the affected tooth with pieces of root. Young leaves are chewed and rubbed hard into a recent snake bite, while an infusion of leaves is applied to the ear as a remedy for ear-ache. For fresh cuts or wounds, break the fruit and apply the contents. The plant is also widely used for chest pains, ringworm, and syphilis. The fruit juice applied over a finger with a whitlow is said to draw it out. The fruits are also used for the treatment of skin diseases. The fruit's juice is squeezed into sheep's nostrils to cure sheep cough. The fruit, although known to be poisonous, is given to children as an emetic. The fruit should be used with some care as it is toxic (Kokwaro, 1976).

In the treatment of delayed expulsion of afterbirth pieces of the root are boiled and the brew taken in a single dose; or the root is dried, ground and mixed with porridge (Harjula, 1980). The fruit of S. incanum is used as a snake-bite remedy, the root for abdominal pains, liver trouble and carbuncle, and the gall for ear-ache. The plant is also used as a remedy for tooth-ache and sore-throat (Watt and Breyer-Brandwijk, 1962).

A decoction of the roots is used a a remedy for stomach-ache, epilepsy, convulsions in children and hernia. For constipation a fresh fruit is cut and the contents smeared on the anus. The ripe fruit is crushed and smeared on the toes to get rid of or prevent infection by jiggers.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

None specified

7. HARVESTING, CONSERVING AND PREPARATION

The fruits are picked and the leaves plucked from the plant while the roots are excavated. The ripe fruit is crushed to obtain the juice which is used for the remedies already mentioned. The young leaves are chewed and applied to the affected area. The roots are washed and a decoction is prepared by placing them in cold water, bringing it to the boil, simmering for a while and allowing the mixture to stand for some time. The liquid obtained is decanted and used for remedy. After excavation the roots are washed, dried in the sun, tied in small bundles and stored in a dry place. The fruit and leaves are not stored because they lose their effectiveness when they dry out.

8. ECONOMICS AND MARKETING

No investigation has been carried out into the economics of the medicinal values of S. incanum. Since the plant grows naturally almost everywhere in Tanzania, it is often collected and used free of charge. However, medicine men collect it and mix it with other herbs to sell. There will probably be a greater demand for it following the research being carried out by the Traditional Medicine Research Unit, so it may become necessary to collect it on a commercial scale.

9. SILVICS

S. incanum regenerates naturally from seed and coppice. On ripening the fruit decomposes releasing the seed which under suitable conditions germinates readily. However, most of the seedlings which germinate towards the end of the rainy season succumb to drought. The plant matures and yields fruit within one growing season i.e. three to five months.

The species is very sensitive to competition especially under the shade of big trees. In open areas it tends to be a dominant plant. A rough sampling carried out at Muheza and Iringa gave the stocking of 33 plants/26m^2 and 29 plants/30m^2 respectively.

There have been no efforts to regenerate S. incanum artificially. However, given the good germination capacity of the seed, the species could be raised artificially by direct sowing of seed in cultivated fields. This practice might be necessary if large quantities of the plant were needed. Weeding might be necessary if a high yield is required.

10. MAJOR DISEASES

None specified.

11. OTHER USES

Traditionally, the Meru have used the fruit in magic ceremonies connected with the preparation of a corpse and the burial procedure (Harjula, 1980).

The leaves are used for cleaning oily utensils.

The very young fruit are edible.

12. BIBLIOGRAPHY

Anon (1976) Atlas of the United Republic of Tanzania. Surveys Division. Min. of Lands, Dar es Salaam.

Harjula, H. (1980) Mirau and his Practice. A study of the Ethnomedicinal Repertoire of a Tanzania Herbalist. Tri-Med. Books. London. 223 p.

Kokwaro, J.O. (1976) Medicinal Plants of East Africa. E.A. Literature Bureau. Nairobi.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) The medicinal and poisonous plants of Southern and Eastern Africa. E. & S. Livingstone Ltd. London. 1455p.

PLATE XXXI. Solanum incanum L.

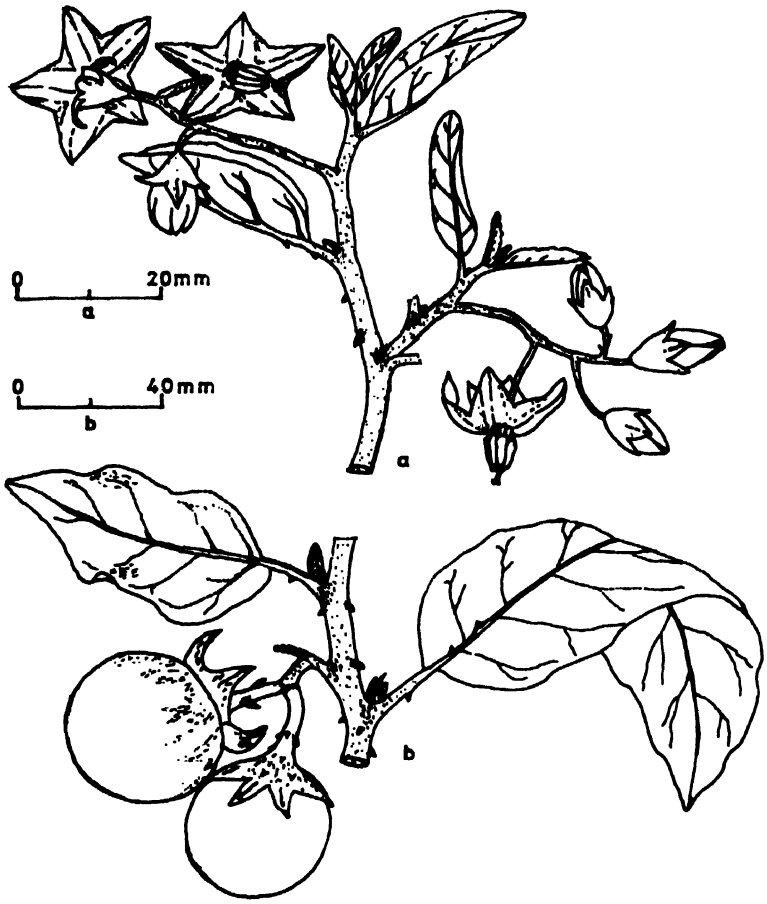


Plate XXXI

Solanum incanum L.

a. branchlet bearing flowerbuds and flowers

b. branchlet bearing mature fruits

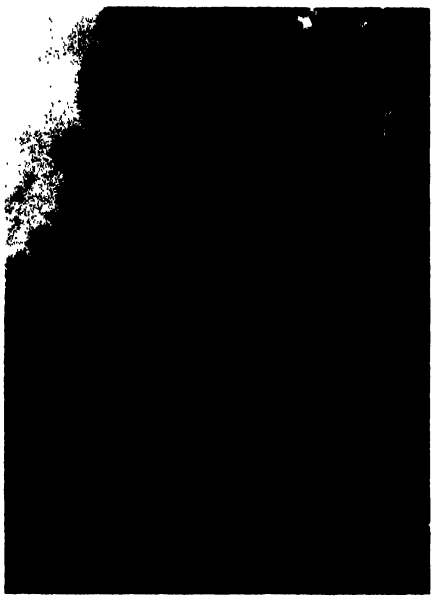
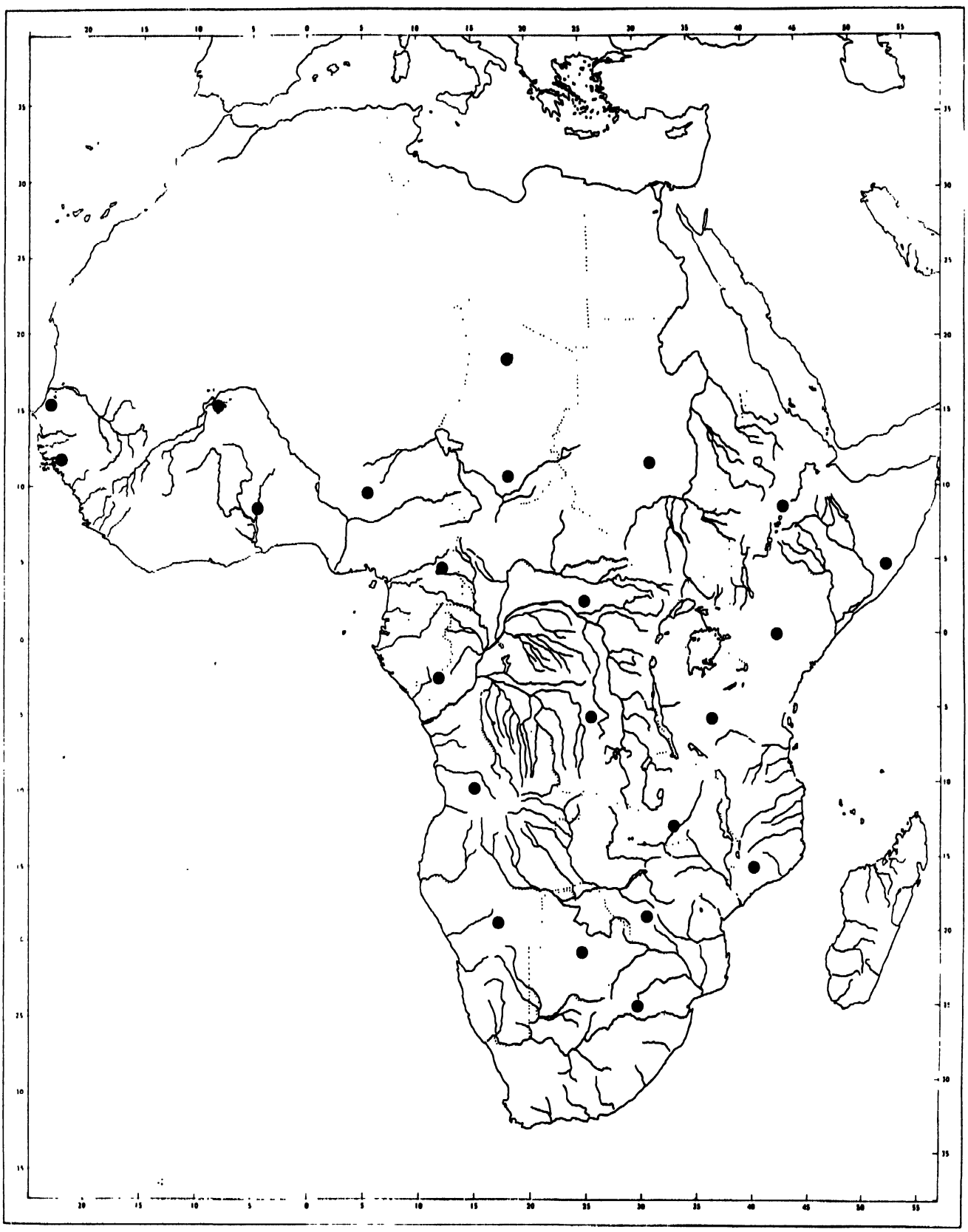


Plate XXXI-1 plant at Muheza, Tanga, May, 1983 (Photo Ruffo)

Plate XXXI-2

branchlet bearing ripe fruits (Photo Ruffo)

MAP 31 - Geographic distribution of Solanum incanum L.



1. BOTANICAL NAME: Strychnos icaja Baill.

SYNONYMS:
Strychnos kipapa Gilg
Strychnos dewevrei Gilg
Strychnos pusilliflora S. Moor
Strychnos mildbraedii Gilg
Strychnos dundusanensis De Wild.
Strychnos venulosa Hutch.

FAMILY: Loganiaceae

COMMON NAMES: Pepere (Twi), Mbondo, Kpo, Mempandi, Kpombondo (Cameroon), Mbenge (Zandi), Mwavi (Kiswahili), Kinyakabi (Kitembo), Samba (Turumbu), Kampopi (Tschiluba), Benge (Babua), Bwende (Kitalinga), Dama, Ghasambe, Sambedale (Ugwalla).

2. ECOLOGY AND NATURAL DISTRIBUTION

A liane of rainforest, secondary forest, swamp and gallery forests of Africa, occurring at altitudes ranging from sea level to 800m on lateritic and sandy clay soils.

In the absence of any published information the climatic parameters have been obtained comparing the distribution of the species with the climatic diagrams of Walter and Lieth (1969).

The inferred rainfall is 1350-2500(-4000)mm per annum with rain throughout the year. The mean annual temperatures are 23-26°C. The species is unlikely to be frost tolerant.

The species occurs in Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Central African Republic, Rio Muni, Gabon, Congo, Zaire and Angola (see distribution map).

3. DESCRIPTION

Liane, 20-100m long, 4-15cm in diameter; bark thin, pale grey to dark brown, with large lenticels; branches often umbellately branched. Leaves opposite, petiolate; petiole 4-12mm long, glabrous; lamina elliptic, narrowly elliptic, narrowly ovate or sometimes ovate, 5-15cm long, 2-7cm wide in the shade, and in the young plants (growing in the shade on the forest floor) up to 21cm long, 10cm wide, apex acuminate, apiculate, or in the shade, caudate, base cuneate or rounded, glabrous, coriaceous to papyraceous, glossy dark green above, similar beneath or less glossy and paler, midrib prominent, one pair of secondary veins from or from just above the base curving along the margin. Inflorescence axillary compound cymes, 3-7cm long, several together, lax, few to many flowered peduncle and pedicels glabrous; bracts small, sepal-like, glabrous, lower bracts up to three times as long as sepals; flowers hermaphrodite, 4-merous. Sepals pale green, broadly ovate to suborbicular, 0.4-1mm long, 0.4-1mm wide, connate at the base for about two-fifths of their length; corolla greenish-yellow to yellowish-white, corolla-tube short, lobes oblong to ovate, 1.6-1.8mm long, 1-1.2mm wide, spreading; stamens exerted, filaments short, inserted in the mouth of the corolla-tube, anthers suborbicular, 0.4-0.6mm long; ovary globose, 0.5-0.6mm long, 2-celled, abruptly narrowed into the style, style 0.4-0.8mm long, stigma capitate. Fruit baccate, indehiscent, dark yellow, globose, 2.5-3cm in diameter, 1-seeded; seed ellipsoid, 16 x 15 x 9 - 21 x15mm, testa woolly, deciduous, sticking to the pulp (Leeuwenberg, 1969).

There are insufficient fertile herbarium specimens to show any seasonal trends in flowering and fruiting.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The plant itself has no established medicinal or pharmaceutical use. Strychnine and the related 12-hydroxystrychnine are known to occur in the root, stem and leaf; there is no evidence as yet that these alkaloids are present in the seeds (see (6)). The two compounds are the principal active substances in the plant and have similar pharmacological properties. Strychnine is sometimes used as a respiratory stimulant in certain cases of poisoning. Being bitter, the alkaloid improves the appetite and digestion, but it is in no way a 'general tonic'. S. icaja could be used as a local source either of an extract or of a partially purified mixture of strychnine, 12-hydroxystrychnine, and other tertiary alkaloids; cf. (6).

5. FOLK MEDICINAL USES

The root is said to have been used against malaria (Bisset, 1970) and macerated in palm wine for treating painful gastro-intestinal conditions and hernia (Bouquet, 1969).

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The tertiary indole alkaloids strychnine and 12-hydroxystrychnine are present in the leaves, stems and roots (Sandberg et al., 1973; Bisset and Khalil, 1976; cf. Sandberg and Kristianson, 1970).

More recent studies of the alkaloids present in the roots have demonstrated the occurrence of the dimeric tertiary alkaloids bisnordihydrotoxiferine and as much as 2% sungucine; in the quaternary alkaloid fraction N_b-strychninium is a major component (Kambu et al., 1979; Lamotte et al., 1979). Pharmacological experiments have shown that the quaternary alkaloid fraction, which is more water-soluble than the tertiary alkaloid fraction, has pronounced muscle-relaxant activity, due probably to blockade of the motor-end plate receptors normally stimulated by acetylcholine; however, further work is required to elucidate more precisely the mechanism of action. At the same time, this alkaloid fraction has a powerful cardiotoxic action, with negative chronotropic and inotropic effects ending in irreversible cardiac arrest.

Thus, depending on the extraction solvent, it may be possible to prepare alkaloid extracts from the roots having predominantly convulsant (Strychnine-like) or muscle-relaxant properties (Kambu et al., 1980).

Saponins, iridoids and phenolic compounds also appear to be present in S. icaja (Bouquet, 1968; Denoël et al., 1953), but, compared with the alkaloids, they probably have little activity.

7. HARVESTING, CONSERVING AND PREPARATION

The part of the plant richest in alkaloids is the root bark. The roots should therefore be dug up, cleaned, and the bark removed before the whole root dries out (scraping off the bark then becomes more difficult). After drying and powdering, the material can be subjected to a conventional alkaloid extraction procedure and the extract then divided into tertiary and quaternary alkaloid fractions which can be further purified for use. Alternatively, if it is only the strychnine-like activity that is required, the stem bark or leaves can be taken, which will do less damage to the plant, and extracted.

8. ECONOMICS AND MARKETING

No commercial value as yet.

9. SILVICS

No reference of it being grown under cultivation. Field observations indicate good natural regeneration from seed, also from suckers.

10. MAJOR DISEASES

None specified.

11. OTHER USES

Because of the toxic properties of the plant, its reddish coloured root bark has been an ingredient in arrow poisons prepared for hunting (Bisset and Leewenberg, 1968). The root bark and fruits are also in use as a fish poison. Roots of young plants, which have a lower toxicity than mature vines, used as an ordeal poison (Raponda-Walker and Sillans, 1961; Bouquet, 1969).

12. BIBLIOGRAPHY

Bisset, N.G. (1970) The African species of Strychnos. Part I. The ethnobotany. Lloydia 33, 201-243, 214.

Bisset, N.G. and Khalil, A.A. (1976) New alkaloids from Strychnos icaja. Phytochemistry 15, 1973-1976.

Bisset, N.G. and Leeuwenberg (1969) The use of Strychnos species in Central African ordeal and arrow poisons. Lloydia 31, 208-222.

Bisset, N.G. and Phillipson (1971) The African species of Strychnos. Part II. The alkaloids. Lloydia 34, 1-60, 31-34.

Bisset, N.G., Das, B.C. and Parello, J. (1973) Alkaloids from the leaves of Strychnos icaja Baill. Tetrahedron 29, 4137-4148.

Bouquet, A. (1968) Recherches chimiques préliminaires sur quelques plantes médicinales du Congo-Brazzaville. Médicine Tropicale 28, 49-58.

Bouquet, A. (1969) Féticheurs et médicines traditionelles du Congo (Brazzaville). Mém. O.R.S.T.O.M. no. 36, 148-151.

Denoel, A., Jaminet, F., Detilleux, G., Van Sumsen, M. and Merveille, L. (1953) Contribution a l'étude chimique des Strychnos du Congo Belge. Ministère des Colonies. Direction de l'Agriculture. Bruxelles, 105-130.

Kambu, K., Coune, C. and Angenot, L. (1979) Nouveaux alcaloides des racines du Strychnos icaja. Planta Medica 37, 161-164.

Kambu, K., Kaba, S., Cambier, E., Nzuzi, K. and Angenot, L. Action neuro-musculaire
(1980) et cardiaque d'un extrait alcaloidique de Strychnos icaja. Plant Medica 40, 356-360.

Lamotte, J., Dupont, L., Dideberg, O., Kambu, K. and Angenot, L. Isolation and
(1979) and structure of sungucine: a new type of bisindoline alkaloid. Tetrahedron Lett. 1979, 4227-4228.

Leeuwenberg, A.J.M. The Loganiaceae of Africa VIII: Strychnos III. Belmontia
(1969) Taxonomy 10, 1-316.

Raponda-Walker, A. and Sillans, R. Les plantes utiles du Gabon. Paris.
(1961) Paul Lechevalier.

Sandberg, F. and Kristianson A comparative study of the convulsant effects of
(1970) Strychnos alkaloids. Acta Pharm. Suecica 7, 329-336.

Sandberg, F., Roos, K., Ryrberg, K.J. and Kristianson, K. The pharmacologically
(1969) active alkaloids of Strychnos icaja Baill.; strychnine and a new alkaloid, 4-hydroxystrychnine. Acta Pharm. Suecica 6, 103-108. Cf. Tetrahedron Lett. 1968, 6217-6218.

Walter, H. and Lieth, H. Klimadiagramm Weltatlas. Jena: Fischer.
(1969)

PLATE XXXII. Strychnos icaja (Baill.)

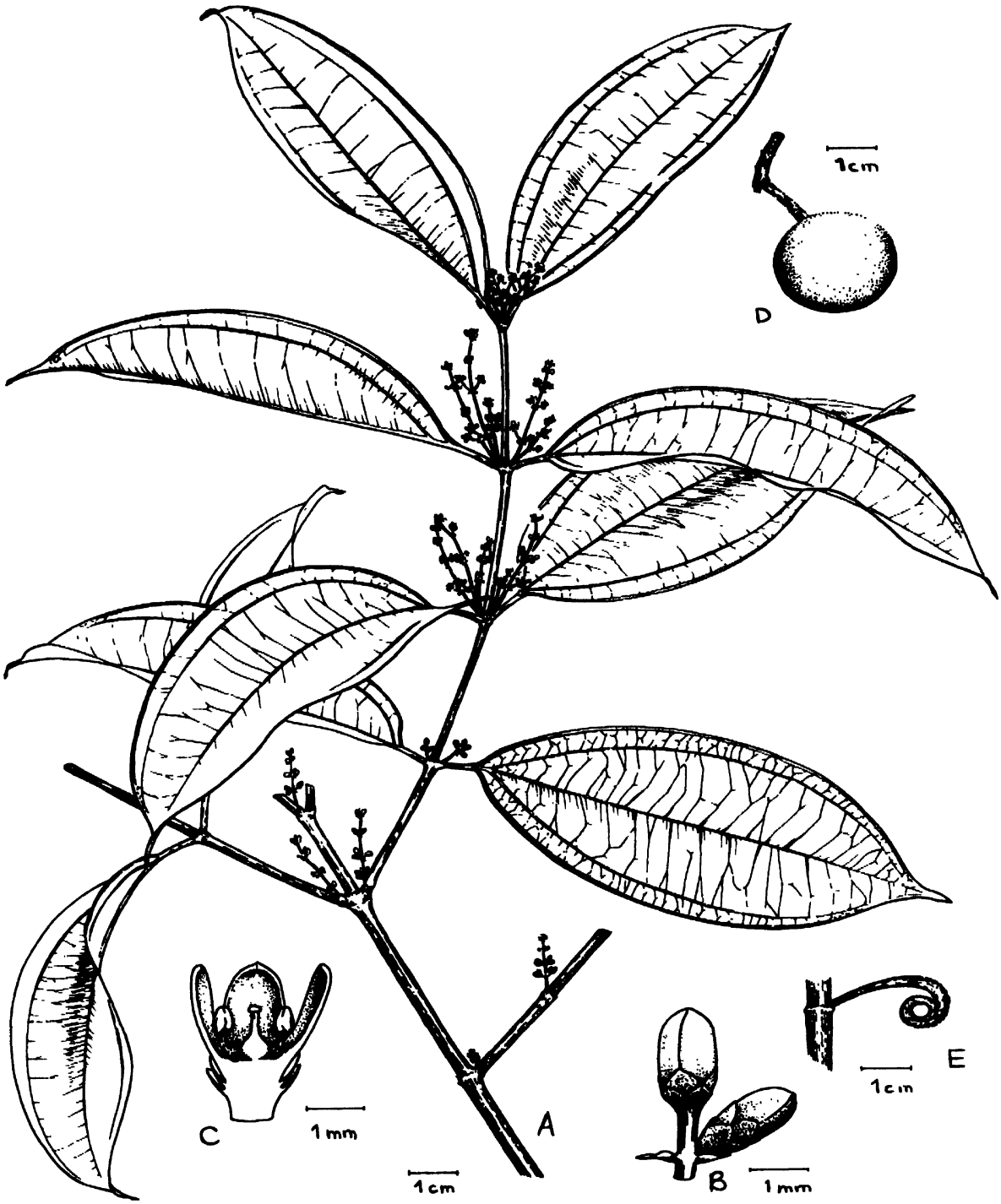
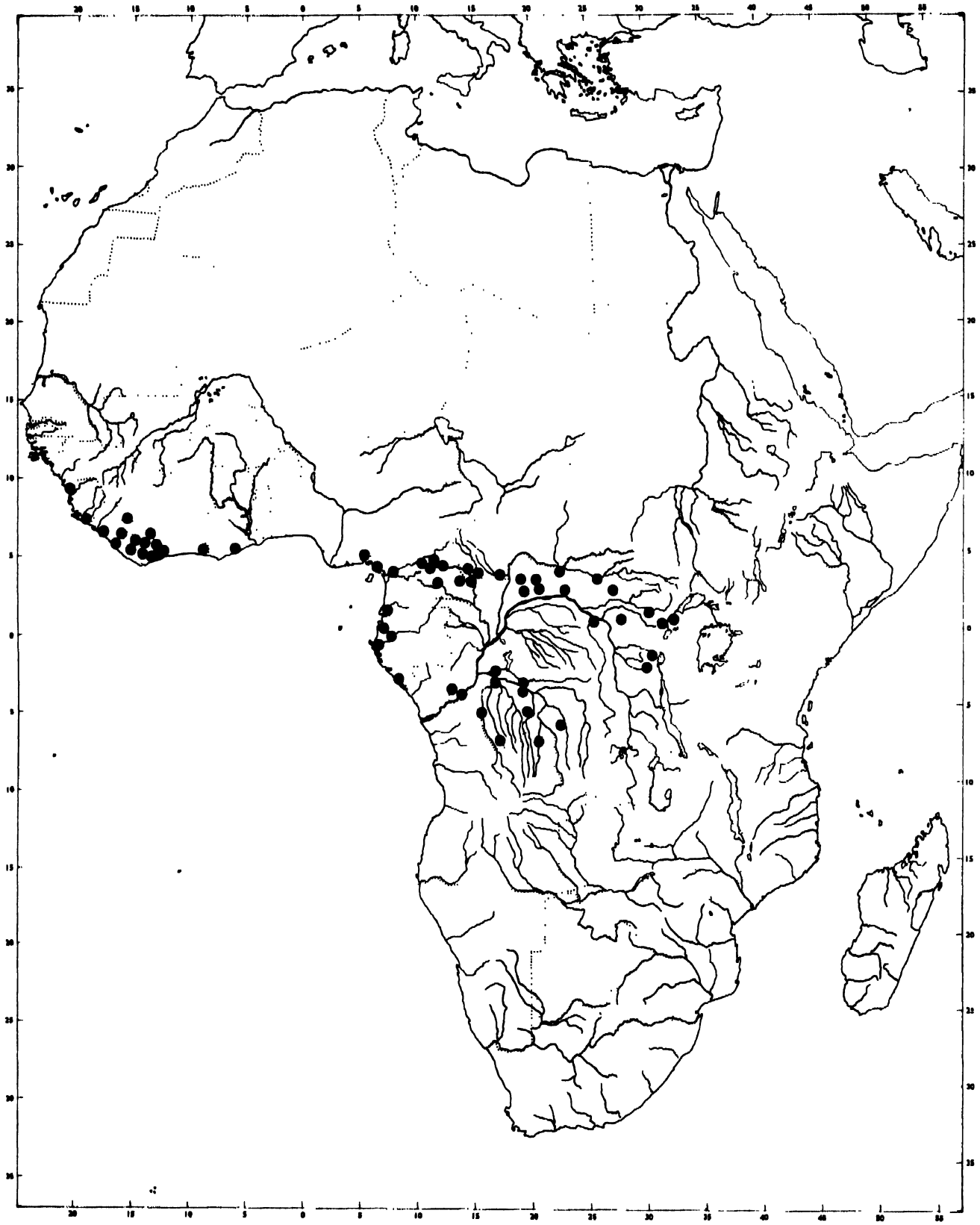


Plate XXIII. Strychnos icaja (Baill.)

		Bar scale
A.	habit	1 cm
B.	bud	1 mm
C.	longitudinal section of flower	1 mm
D.	fruit	1 cm
E.	tendril	1 cm

MAP 32 - Geographic distribution of Strychnos icaja



1. BOTANICAL NAME: Styrax camporum Pohl

SYNONYMS: Styrax chrysasterus Pohl
Styrax obliquinervium A.DC.
Styrax candollei Seub.
Styrax gardnerianum A.DC.
Strigilia camporum (Pohl)Miers

FAMILY: Styracaceae

COMMON NAMES: Laranjinna do cerrado, Estoraque do campo, Benjoeiro, Beijoeiro, Incense of America (Brazil); Cedrillo, Cartucillo (Venezuela).

2. ECOLOGY AND DISTRIBUTION

Styrax camporum occurs on the poor, acid soils of the 'cerrados'.

It is native to Brasil and is to be found in Minas Gerais, Bahia, Sao Paulo and other southern states (see distribution map).

3. DESCRIPTION

Small tree or shrub to c.4 m high; bark brittle, copious yellow resin from trunk when cut; young branches not hairy, older branches grey. Leaves alternate, simple; stipules absent; petiole 6-18mm long; blade oblong, oblong-ovate, oblong lanceolate or lanceolate, 6-14cm long, 2-4.5cm wide, apex acuminate, base rounded to subcuneate, margins entire, subcoriaceous, glabrous and dark green above, yellowish-white tomentose below. Inflorescence racemose, terminal or axillary, 5-10cm long, 2-10-flowered. Calyx cup shaped, 4-5mm long, very shallowly 5-lobed; corolla white to yellowish-white, tube 3mm long, petals strap-shaped, 12mm long, 3mm wide; stamens 10, inserted at the base of the corolla; ovary superior, imperfectly 3-septate, 2 ovules per loculus, style solitary, up to 13mm long. Fruit a small capsule 1-2cm long with persistent calyx; seed with straight embryo.

Flowering generally throughout the year, even in the driest months of July and August.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The resin is used as a tincture, soaked on cotton and pressed into carious teeth. It is used in Europe and North America (Lewis et al., 1977).

5. FOLK MEDICINAL USES

The main use of the resin is in traditional medicine, either as an externally used antiseptic soap for dermatosis or taken internally as a carminative, anti-asthmatic, expectorant and for malfunctions of the digestive system. An infusion prepared in hot water is taken orally for ulcers.

The resin is yellow but gradually darkens in colour as it dries. It is very perfumed, composed of vanillin and aromatic oils and smells like vanilla.

A tincture of S. camporum is used as an expectorant for the bronchial tubes, hoarseness and insomnia, with a maximum dose of 10 ml. Ferreira (1980), refers to the popular utilization of the resin as a narcotic.

6. MAJOR CHEMICAL CONSTITUENTS

There are no traceable reports of the chemical constituents of this plant but it is likely to contain styracin (cinnamyl cinnamate), styrene (phenylethylene) and benzaldehyde as well as traces of vanillin (see 5). The exposed resin becomes hard and brittle at room temperature but pliable when heated or chewed. (Morton, 1977)

7. HARVESTING, CONSERVING AND PREPARATION

The resin is exuded when the bark of the trunk is slashed (see 8) and dries on exposure to the air. It is secreted in cavities and channels in the new wood close to wounds.

8. ECONOMICS AND MARKETING

The species' main importance is the utilization of the resin which is known throughout Tropical America and Asia (Lainetti and Brito, 1979). The resin is collected from wounds in the trunk, and occurs in an attempt to cicatrize the bark. At the beginning of this century it was greatly used in the perfumery industry but is little used nowadays.

9. SILVICS

Styrax is readily grown from seed which can be germinated in nursery beds or boxes or sown directly in the field.

10. MAJOR DISEASES

There is no record of any diseases to which the tree is subject.

11. OTHER USES

The resin is used as incense in religious ceremonies.

The species flowers all year round and the flowers give off a pleasant perfume. So it is used as an ornamental plant for parks and public gardens.

12. BIBLIOGRAPHY

Ferreira, M.B. (1980) Plantas Portadoras de Substâncias Medicamentosas de Uso Popular, nos Cerrado de Minas Gerais. Inf. Agropecuario. Belo Horizonte. 6(61): 19-23.

Lainetti, R. and Brito, N.R.S. (1979) A Cura Pelas Ervas e Plantas Medicinais Brasileiras. Ed. Ouro. DF, Brasil. 169 p.

Lewis, W.H. et al. (1977) Medical Botany, Wiley & Sons, N.Y. 521 p.

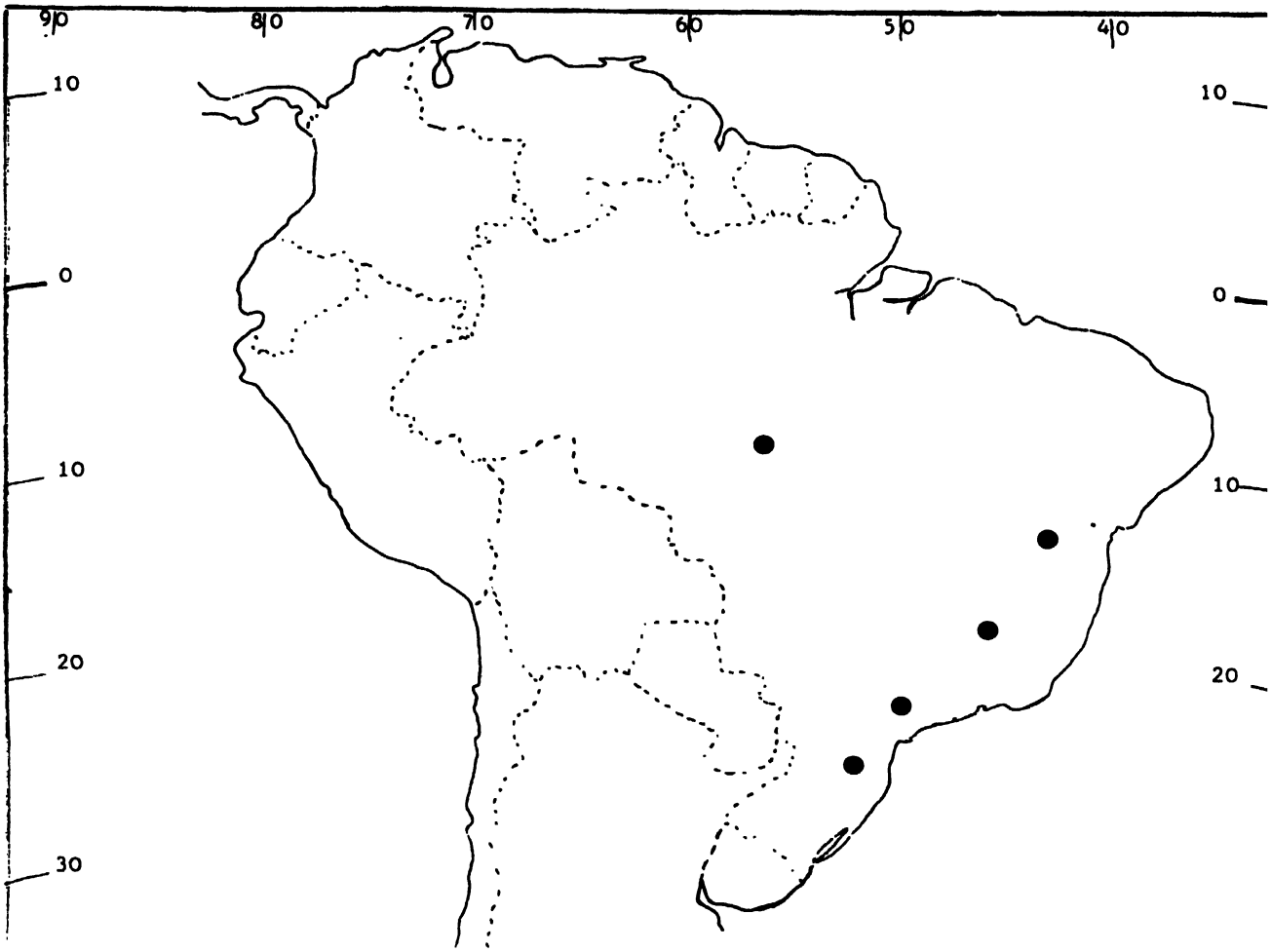
Morton, J.F. (1977) Major Medicinal Plants, Botany Culture and uses; Charles C. Thomas, Banneistone House, 301-327, Springfield, ILL. U.S.A.

PLATE XXXIII. Styrax camporum Pohl.

Plate XXXIII. Styrax camporum Pohl.

A. flower B. longitudinal section of flower
C. detail of anther D. floral bud E. cross section of ovary
F. longitudinal section of gynoecium G. fruit
(From Ratter, J.A. et al., exsiccate 3621 and 11360 UB)

MAP 33 - Geographic distribution of Styrax camporum



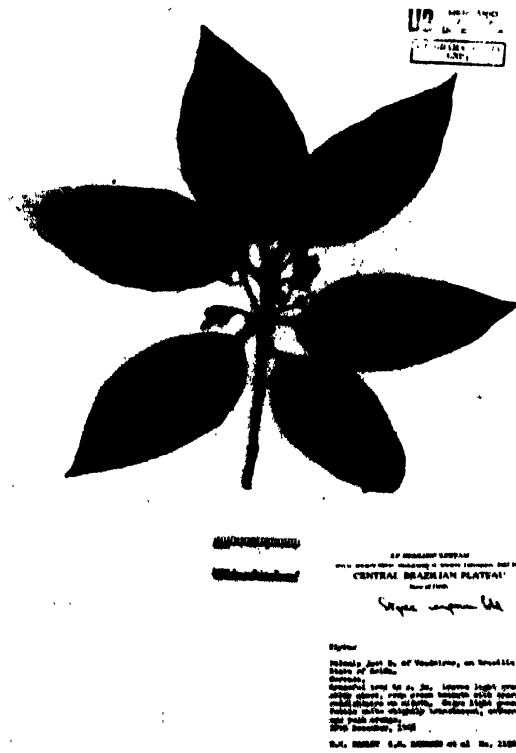


Plate XXIII-1

Herbarium specimen
Universty of Brasilia

1. BOTANICAL NAME: Talauma mexicana (DC.)Don

SYNONYMS: Magnolia mexicana DC.
Talauma macrocarpa Zucc.

FAMILY: Magnoliaceae

COMMON NAMES: Flor del corazon; Cuhui-xana (Totonaco); Chocoijoyo (Zoque); Flor de atole, Flor de las mataduras, Guia-lacha-yati (Zapoteca); Jolmashte (Tzeltal); Magnolia mexicana, Yolo, Yoloxochitl - "flower of the heart" (Nahuatl); Anonilla (Yucatan).

2. ECOLOGY AND DISTRIBUTION

Talauma mexicana is a tree of cultivated areas, deciduous woodlands and high evergreen forests at altitudes ranging between 110 and 2900m. In Mexico it occurs in the States of Chiapas, Mexico, Guerrero, Morelos, Oaxaca, Puebla and Vera Cruz in a belt in which the high evergreen forests alternate with secondary vegetation.

The species occurs in Mexico, Honduras and Guatemala; it is sometimes cultivated (see distribution map).

3. DESCRIPTION

An evergreen tree up to 30m high; trunk up to 1.5m in diameter; glabrous or almost so. Leaves alternate, simple; stipules lanceolate, 2-5cm long, at first united with the petiole, finally deciduous and leaving a conspicuous scar; petiole up to 9cm or more long; blade ovate or elliptic, 8-30cm long, 4-12cm wide, apex acute or obtuse, base cuneate, margins entire, coriaceous. Florescence terminal, solitary. Sepals 3, white, oblong or obovate, 4-10cm long, 3-7cm wide, apex truncate, fleshy, glabrous; petals 6, white with reddish markings, thick and leathery, in 2 whorls or 3, outer obovate, 8-10cm long, 5-7cm wide, inner 7-8cm long, 5-6cm wide; stamens numerous; carpels numerous. Fruit multi-folliculate, obovoid, 10-15cm long, woody; follicles 2-seeded, woody; seeds bright breen surrounded by fleshy red aril and hanging from a white, thread-like funicle, obovoid, 7-12mm long.

Flowering May to July.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

Scientific study of the composition and properties of T. mexicana began at the end of the last century in Mexico. It was then concluded that the plant possessed a glucoside substance called talumine, to which pharmacological effects on the action of the heart were attributed. Tinctures and other extracts were prepared from the bark, leaves and flowers of T. mexicana and tested on various animals and even in clinics. From these studies it was concluded that the fruit and bark of the tree contained substances which affected the action of the heart, slowing down the rate and increasing the force of its beat, and regularizing it. From then on Talauma was included in national pharmacopoeia as a useful drug in the treatment of cardiac deficiency, possessing cardiotonic glucoside properties. It was even put forward as a national substitute for digitalis.

5. FOLK MEDICINAL USES

Its close resemblance to Magnolia grandiflora has led to the two trees being frequently confused and similar medicinal properties being attributed to them. The classification of Talauma mexicana, was made in the XVIII century, when its leaves and flowers were considered to possess tonic properties, stimulating and of great benefit for cardiac complaints. However, in earlier times the Mexican people attributed to them sedative effects and other properties which cannot be clearly identified owing to the little knowledge we have of the original Aztec medicine.

The flowers stay on the tree from May to July and are bought in great quantities in the markets of the capital and of the towns in south-eastern Mexico. At present T. mexicana is used mainly as a medicine, in the form of a syrup used to prevent epileptic attacks and also to treat various cardiac ailments, tonic properties being attributed to it.

The bark of the tree is used to prepare an infusion useful in the treatment of fevers, and cardiac glucoside properties are attributed to it. Its fame as a remedy for heart complaints led to it being incorporated in the symbol of the Instituto Nactional de Cardiología. The flower buds are dried in the sun and sold in the markets in bright garlands. Three or four petals boiled in half a litre of water is the usual dose for an infusion for the treatment of cardiac affections and as a sedative.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

In later years the cardiotonic action of the flowers, leaves and bark of Talauma were proved. Various purified extracts of these parts of the plant have a vasoconstrictive, hypertensive and cardiotonic effect. In the middle of the present century the alkaloid aztequina was obtained from the leaves of Talauma, and this does not have a heart-stimulant effect. It was postulated that substances known to exist in Magnolia grandiflora, magnoline and magnolamine alkaloids which produce inhibition of the vasomotor nerves and a peripheral effect of an adrenolitic type were present also in Talauma. Magnoline also appears to be an inhibitor of colinesterase; while magnolamine is a vigorous hypotensive.

Recently pharmacological studies have been conducted with infusions of Magnolia and Talauma in comparative cardio-vascular tests, showing that the first produces a negative chronotropic effect on the heart of the dog, accompanied by fleeting but intense arterial hypotension, while the Talauma has an aminergic effect, contracting the blood vessels and producing a notable increase in the frequency of the contractions of the heart. The tonic effect of Talauma suggests the presence in the plant of notable products whose stimulative action on the nervous and cardiovascular system makes this one of the most important plants in Mexican herbalism.

7. HARVESTING, CONSERVING AND PREPARATION

The bark and leaves and flowers are collected and used (see 5).

8. ECONOMICS AND MARKETING

Products dried and marketed locally (see 5).

9. SILVICS

The species can be grown from seed.

10. MAJOR DISEASES

No information available.

11. OTHER USES

It is often grown as an ornamental and powdered flowers are used to flavour chocolate and other foods (Morton, 1981).

12. BIBLIOGRAPHY

Armendáriz, E. (1891) — El Estudio (Méx). 4: 248.

Armendáriz, E. (1893) — El Estudio (Méx). 4: 375.

Armendáriz, E. (1914) — Gaceta Médica (Méx.) 9(6): 188.

Collera, O. (1963) — Bol. Inst. Quím. UNAM. (Méx.) 15: 38.

Cowan, F. (1975) — Anthropological Papers. Museum of Anthropology, University of Michigan. 60: 271.

Flores, L. (1907) — Anal. Inst. Méd. Nal. (Méx.) 9: 378.

Guerra, F. (1939) — Arch. Latinoamericanos de Cardiología y Hematología. 1939, 9: 251; 1940, 10: 197; 1941, 11: 69.

Lozoya, X. (1980) — Amer. Jour. of Chinese Med. 8(1): 86.

Matsutani, H. (1975) — Phytochemistry. 14: 1132.

Mellado, V. (1980) — Arch. Invest. Méd. (Méx.) 11: 335.

Morton, J.F. (1981) — Atlas of Medicinal Plants of Middle America, Bahamas to Yucatan. C.C. Thomas, Publisher, Springfield, ILL. U.S.A.

Pardo, G. (1951) — J. Pharmacol, Exp. Therap. 101: 63.

Pardo G. (1957) — Ciencia (Méx.) 17: 15.

Pérez, C.R. (1937) — Arch. Lationamericanos de Cardilogía y Hematología. 1937, 7(3,4): 87; 1937, 7(6): 173; 1938, 8(3): 109.

Pérez, C.R. (1944) — Ciencia (Méx.) 5:200.

Petkov, V. (1979) Am. J. Chin. Med. 7(3): 197.

Rao, K. (1975) Planta Medica. 27: 31.

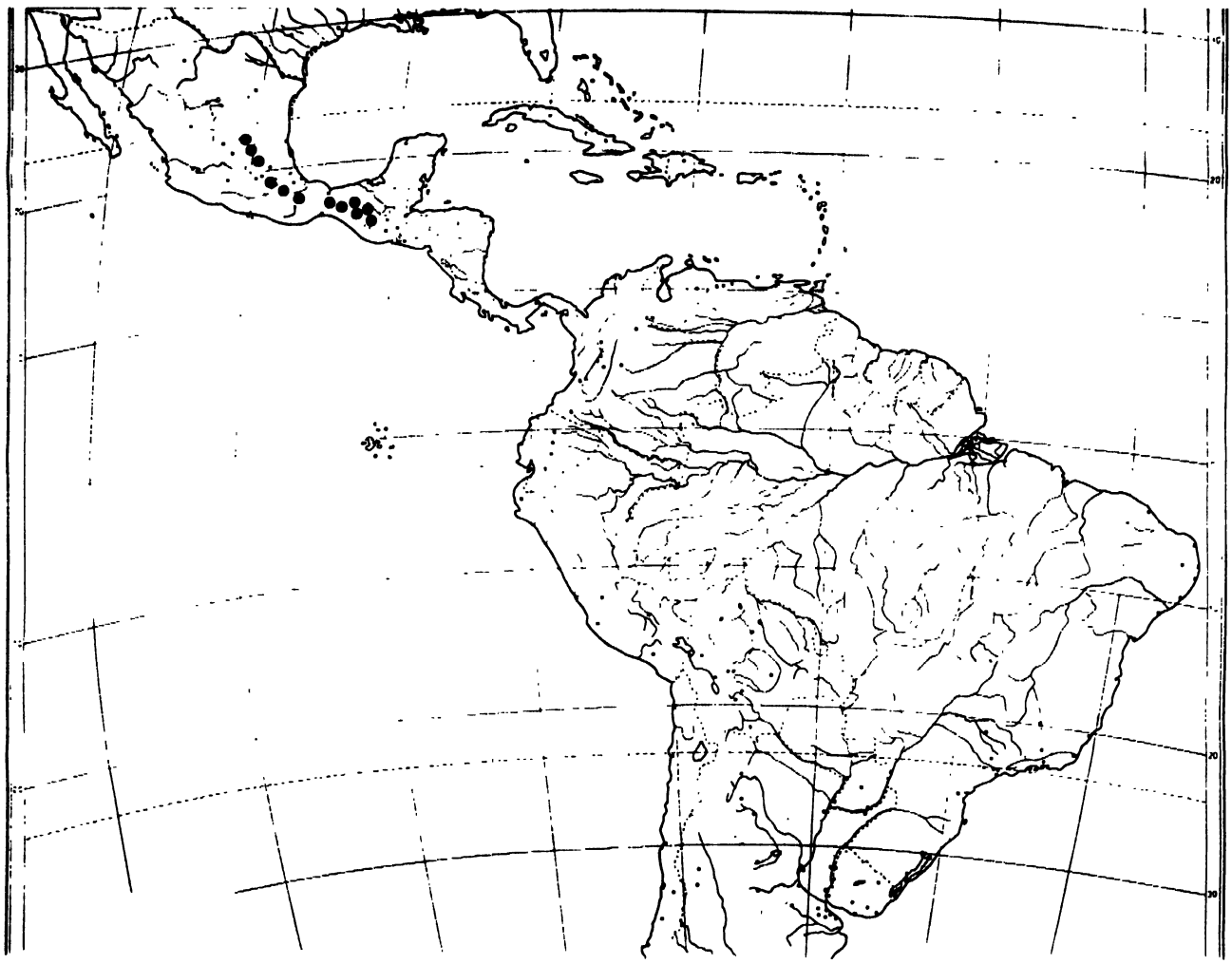
Sodi, P.E. (1947) Cardiología (Méx.) 17: 833.

Weidhophf, R. (1973) J. Pharm. Sci. 62: 345.

PLATE XXXIV. Talauma mexicana (DC.) Don

Plate XXXIV. Talauma mexicana (DC.) Don.
A. branchlet with flower B. fruit (x ½)
(After Pennington T.D. and Sarukhan, J. (1968) Manual para la Identificacion de Campo de los Principales Arboles Tropicales de Mexico, FAO/UNDP/INIF Mexico)

MAP 34 - Geographic distribution of Talauma mexicana



1. BOTANICAL NAME: Tecoma stans (L.)Kunth

SYNONYMS: Bignonia stans L.
Tecoma mollis Kunth
Stenolobium stans (L.)Seem.
Stenolobium incisum Rose and Standley

FAMILY: Bignoniaceae

COMMON NAMES: Retamo, Trompetilla, Flor de San Pedro, Corneta amarilla, Hierba de San Nicolas, Hierba de San Pedro (Mexico); Sauco amarillo (Cuba, Puerto Rico); Copete (Panama); Sardinillo (Nicaragua); Palo hueso (Colombia); Tasto (El Salvador); Candelillo (Costa Rica); Garrocha (Argentina); Xkanlol (Maya); Guiebichi (Zapoteco); Nixtamaxochitl (Nahuatl); Tronadora (Mexico).

2. ECOLOGY AND DISTRIBUTION

Tecoma stans is now widely cultivated throughout the tropics. It is probably native to Mexico or the West Indies and is now naturalized in tropical America.

3. DESCRIPTION

A shrub or small tree, up to 12m high; trunk up to 25 cm in diameter; branches with many raised lenticels, lepidote when young. Leaves opposite, pinnate; stipules absent; rachis 14cm or more long; leaflets sessile or subsessile, 1-4 pairs opposite leaflets and an odd terminal leaflet, lanceolate, elliptic-lanceolate or ovate-lanceolate, 3-13cm long, 1-4cm wide, apex long attenuate and acuminate, base cuneate, margins sharply serrate, papery, glabrous or pilose along the midrib below, especially in the axils of the main nerves, translucent glands below. Inflorescence paniculate; flowers numerous, bisexual, irregular, 5-merous; bracts and bracteoles small. Calyx tubular-campanulate, 4-7mm long, lobes glabrous or ciliolate, usually with some impressed glands in the upper half; corolla bright yellow, campanulate-funnel-shaped, 35-55mm long, the limb up to 35mm in diameter, glandular in bud, lobes white and ciliate; 10-22cm long, 0.7cm wide, apex long attenuate, glossy. Seeds transversely oblong with broad, membraneous, whitish wings, ± compressed, up to 7mm long, 30mm wide.

Flowering and fruiting throughout most of the year.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

The alkaloids tecomine and tecostanine isolated from the leaves of T. stans have been administered as salts, intravenously and orally, in normal rabbits and in rabbits with experimental diabetes. The oral dose of 50 mg/kg and the corresponding intravenous dose of 20 mg/kg produced a considerable fall in the levels of glycaemia in the normal animal; in a rabbit subjected to total pancreatectomy, these drugs did not have any hypoglycemiant effect; however, continuous administration of these alkaloids produced an improvement in animals with diabetes induced by aloxana, which seems to indicate that both alkaloids produce their hypoglycemiant effect only when the pancreas is present.

More recent studies have shown that intravenous injection of the watery extracts of leaves of T. stans produces a fall in the levels of blood glucose in a normal anaesthetized dog three hours after the product is injected. Apparently this product does not act on the

pancreas, and the same hypoglycemiant effect has been reported after oral administration of an infusion of T. stans leaves to normal rabbits and rabbits with hyperglycemia and partial pancreatectomy.

These results have led to renewed scientific interest in the study of this very popular Mexican remedy, and points to the need for a more adequate clinical evaluation of the medicinal importance of a resource which, despite the little medical interest it has attracted, continues to be in great demand among herbalists in Mexico and other countries.

5. FOLK MEDICINAL USES

It is not known when T. stans was first introduced into Mexico's traditional medical practices; the old Spanish chronicles of the colonial period do not make any particular reference to the medicinal effects of this plant, although Hernández, a Royal Doctor, described it in his work of 1570 under the indigenous name of nixtamalyxóchitl oapenensi.

At the beginning of the present century, some Mexican scientists included it in their works on medical matters, recommending an infusion of the leaves of T. stans for the treatment of hyperglycaemia. It has also been attributed properties as a eupeptic and general tonic, to combat gastritis of alcoholic origin and dysentery. For such purposes it is recommended that an infusion of the leaves be drunk daily. The roots of the tronadora have been recognized to possess diuretic, tonic and even antisyphilitic properties, although none of these have been scientifically corroborated.

At present the Mexican people use mainly an infusion of the leaves of tronadora to control the symptoms of Diabetes mellitus. The use of Tecoma stans to combat hyperglycaemia for almost 100 years has aroused scientific interest in identifying the principles responsible for this property attributed to Tecoma in folk medicine.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

At the beginning of the present century two products were recognized in the plant: a bitter alkaloid that was called "bignonine", and another volatile alkaloid known as "tecomanine". Attempts to demonstrate by experiments the hypoglycemiant effect of the substances in laboratory animals did not give conclusive results. Later it was reported that an infusion of this plant attenuates sensations of hunger and thirst, and lowers the concentration of sugar in the urine of diabetics. These studies carried out in Mexico in the first decade of the previous century were complemented by others which led to a great interest among scientists in other countries, whose studies will be mentioned later.

The continued and successful use among the people of Mexico of Tecoma stans for the treatment of Diabetes mellitus led to the appearance on the market of a pharmaceutical preparation (fluid extract and tincture) based on tronadora leaves, which later gave rise to two patent medicines (Glucolisina and Diabetoline) which continue to enjoy a great reputation and are much in demand among the people, although their curative powers have not been given official medical recognition. Although it has been known since the last century that alkaloids are present in Tecoma stans, the chemical structure of these compounds was clarified only towards 1960, through the studies started by Hammouda and Motawi. These authors gave the name "tecomine" to one of the pyrindane-type alkaloids extracted from this plant. Later Jones isolated from the same species a second alkaloid, called "tecomanine", whose physical constants corresponded to those described by Hammouda for "tecomine". By agreement between the two, the name now accepted to denote this substance is "tecomine".

Tecostanine was the next alkaloid reported by Hammouda, and in later investigations a whole series of compounds of a monoterpenic nature were identified, in which methylcyclopentane is linked to actinidine or piperidine.

The alkaloids isolated from this plant whose chemical structures have already been correctly established are: tecomanine, tecostanine, tecostidine, boshniakine, 4-noractinidien, N-normetilskitantine, 5-hydroxyskitantine and 5-skitantine.

Biosynthesis of some of these monoterpenic alkaloids has been studied in vitro and it has been shown that lapachol and other primary and secondary metabolites, such as: sugars (glucose, fructose, sacarose and xilose), triterpenoides (ursolic and oleanolic acids and amirine), B sitosterol and phenolic acids (clorogenic, cafeic, vamillic, o-cumaric and sinapic acids) are present in Tecoma stans.

Recently it has been established that aniridoid glucoside is present in T. stans, a compound that had been previously described in other species of the same family of Bignoniaceae.

7. HARVESTING, CONSERVING AND PREPARATION

Collection of leaves, flowers, bark and roots.

8. ECONOMICS AND MARKETING

No information available. As the shrub is widely grown and regenerates profusely, multiplying and often forming thickets it is most likely to be collected directly by users.

9. SILVICS

See (8), the species seeds profusely and is readily propagated from seed.

10. MAJOR DISEASES

None indicated.

11. OTHER USES

It is widely cultivated as an ornamental in tropical and sub-tropical America, and in other tropical areas of the world.

12. BIBLIOGRAPHY

Armendáriz, E. (1903) — Anal. Inst. Nal. 5: 117.

Berg, W. et al. (1977) — Pharmazie. 32: 41.

Boorsma, G.E. (1899) — Meded. Lands. Plantent. 31: 136.

Colin, G.C. (1926) — Jour. Amer. Pharm. Assoc. 15: 556.

Colin, G.C. (1927) Jour. Amer. Pharm. Assoc. 16: 199.

Dickinson, E.M. and Jones, G. Tetrahedron. 25: 1523.

Dohnal, B. (1976) Acta Societatis Botanicorum Poloniae. 45(1): 93.

Dohnal, B. (1976) Acta Societatis Botanicorum Poloniae. 45(4): 369.

Dohnal, B. (1977) Acta Societatis Botanicorum Poloniae. 46(2): 187.

Gross, D. et al. (1972) Phytochemistry. 11: 3082.

Gross, D. et al. (1973) Phytochemistry. 12: 201.

Guerra, F. (1946) Rev. Inst. Salub. y Enferm. Trop. 7: 237.

Hammouda, Y. and Motawi, M. (1959) Proc. Pharm. Soc. Egypt. 41: 73.

Hammouda, Y. and Plat, M. (1963) Annales Pharm. Françaises. 21: 699.

Hammouda, Y. and Rashid, M. (1964) J. Pharm. Pharmacol. 16: 833.

Hernández, R. y García (1958) Medicina. 788: 1.

Morton, J.F. (1912) Atlas of Medicinal Plants of Middle America; C.C. Thomas, Publisher (1981) 301-327 East Lawrence Ave., Springfield, ILL. U.S.A.

Terrés, J. (1897) Anal. Inst. Méd. Nal. 3: 44.

Villaseñor, F. (1904) Anal. Inst. Méd. Nal. 6: 12.

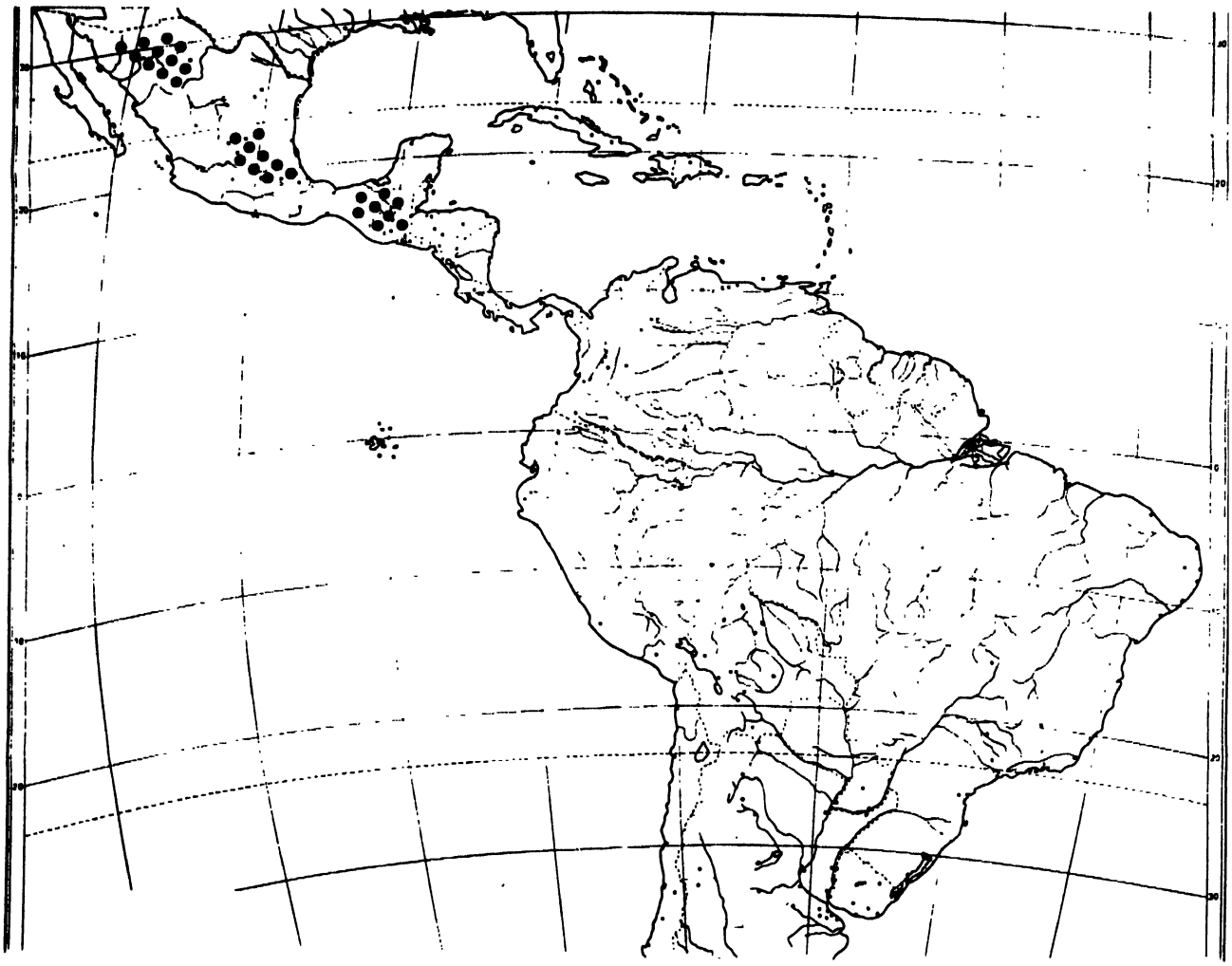
PLATE XXXV. Tecoma stans (L.) Kunth

Plate XXXV Tecoma stans (L.) Kunth

Leaves and flowers

(After O'Gorman J. (1963) Plantas y Flores de México, UNAM, México)

MAP 35 - Geographic distribution of Tecoma stans in Mexico



1. BOTANICAL NAME: Trema orientalis (L.) Blume

SYNONYMS: Trema guineensis (Schum. & Thonn.) Ficalho
Trema guineensis (Schum. & Thonn.) Ficalho var. hochstetteri (Planch.) Engl.

FAMILY: Ulmaceae

COMMON NAMES: Pigeonwood; Sesea (Ashanti, Twi, Wassaw, Fante, Bron), Seazealeba (Nzema), Aisie (Baule), Sekye, Somobra (Anyi), Wadzawadza (Ewe); Afefe (Yoruba), Ehuogo (BIni), Telemukwu (Ibo), Mpesi (Swahili), Mupethu, Muhethu (Kikuyu) Mwesu (Teita), Muethu (Meru), Poponet (Kispigi), Musakala (Kakamega, Tiriki), Mbaranyungu (Taveta), Mutumpu (Bemba), Kambombo (Kaonde), Mcninde (Nyanja), Mululwe (Tonga).

2. ECOLOGY AND DISTRIBUTION

Trema orientalis is common along the margins of lowland and upland rainforest, especially as a pioneer in clearings and abandoned farmland, and extending into forest outliers and riverine forests in the savanna.

Widespread throughout tropical Africa and extending southwards into Natal; also in Madagascar, Mascarene Is., Arabia and tropical Asia (see distribution map).

3. DESCRIPTION

A shrub or small to medium sized monoecious or rarely dioecious deciduous tree up to 15m high; bark smooth, light grey; slash creamy-white to light yellow, fibrous, bright green immediately beneath the bark; twigs pubescent to tomentose. Leaves simple, alternate, stipulate; stipules lanceolate, 4-7mm long, soon falling; petiole 7-15mm long; blade oblong-lanceolate to long-ovate, 2-20cm long, 1.2-7.2cm wide, apex acuminate, base rounded to cordate, margins finely and regularly serrate along the entire length, glossy dark green above, dull, paler green below, vennation depressed above, more or less prominent below. Inflorescences usually congested axillary cymes c. 1cm long in flower, up to 2cm in fruit; flowers numerous, mostly male with a few female or hermaphrodite flowers at the apex. Calyx-tube short, lobes 5, 1-2mm long, greenish; petals absent; stamens 5, shorter than the sepals; ovary pubescent, --celled. Drupe dark purple turning black, thinly fleshy, ovoid to globose, 3-6mm in diameter, glabrous, remains of styles often persistent (Polhill, 1966).

Flowering throughout the year.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None known to date.

5. FOLK MEDICINAL USES

A bark decoction or concoction is a common cough syrup, sometimes used as a vermifuge. A concoction of the leaves is also used as a vermifuge. Powdered leaves have been found to be bitter.

A bark infusion is drunk to control dysentery. Both a bark and a leaf decoction is used as a gargle, inhalation, drink, lotion, bath, or vapour bath, for coughs, sore throat, asthma bronchitis, gonorrhoea, yellow fever, toothache, as a vermifuge, and is known to have antiplasmodic properties. A leaf decoction is given to dogs as an anthelmintic.

6. MAJOR CHEMICAL CONSTITUTENTS AND MEDICINAL PRODUCTS

Ogunkoya and co-workers have extensively examined the chemical constituents of the plant. They have determined the presence of octacosanoic acid and 1-octacosanyl acetate (0.06%); β-sitosterol, triterpenic alcohols and ketones such as simiarenol (3β-hydroxy-friedohop-5-ene)(0.003%), episimiarenol, simiarenone (0.04%), and trematol, a new compound with a 3β-hydroxyl group and an arborane or a migrated hopane skeleton. It also contains saponins and condensed tannins.

7. HARVESTING, CONSERVING AND PREPARATION

No details other than under 5.

8. ECONOMICS AND MARKETING

Locally collected for domestic purposes.

9. SILVICS

The tree regenerates profusely through its numerous seeds and is a common coloniser of disturbed rain forest areas.

10. MAJOR DISEASES

So far not known.

11. OTHER USES

The inner bark is rubbed on locally made ropes to blacken and also to preserve them. The leaves and fruits are reported to be eaten in Zaire. The bark is made into ropes which are also employed as waterproof fishing-lines in Tanzania. The timber is only of fair quality, but widely used as a fuel wood and for charcoal production. A brown dye is obtained from the leaves. Birds feed on the black fruits.

12. BIBLIOGRAPHY

Edited by Aubreville, A. (1963 - in continuation)	Flora du Cameroun. Musée National d'Histoire Naturelle, Paris.
Edited by Aubreville, A. (1961 - in continuation)	Flora du Gabon. Musée National d'Histoire Naturelle, Paris.
Ayensu, E.S. (1978)	Medicinal plants of West Africa. Reference Publications Inc., Algonac.
Dale, I.R. and Greenway, P.J. (1961)	Kenya trees and shrubs, Government of Kenya and Hatchards, 187 Piccadilly, London W.I.
Dalziel, J.M. (1937)	The useful plants of West Tropical Africa. The Crown Agents, London.

Eggeling, W.J. and Dale, I.R. (1951) Indigenous trees of Uganda, Robert MacLehose and Co. Ltd., Glasgow.

Edited by Exell, A.W. and Wild, H. (1960 - in continuation) Flora Zambesiaca. Crown Agents, London.

Holland, J.H. (1922) The useful plants of Nigeria, Vols. 1-4, Royal Botanical Gardens, Kew. Bulletin of Miscellaneous Information.

Edited by Hubbard, C.E., Milne-Redhead, E., Polhill, R.M. and Turrill, W.B. (1951 - in continuation) Flora of Tropical East Africa. Crown Agents, London.

Hutchinson and Dalziel, J.M. 1954-1963) Flora of West Tropical Africa. Vols. 1-2, Crown Agents, London.

Institut National pour l'Etude Agronomique du Congo (Zaire). 1948-1963 Flora du Congo et du Ruanda-Urundi. Vols. 1-10.

Irvine, F.R. (1961) Woody plants of Ghana, with special reference to their uses. Oxford University Press. London.

Keay, R.W.J. et al. 1960, 1964 Nigerian trees. Vol. I and Vol. II. Federal Government Printer, Lagos.

Kokwaro, J.O. (1976) Medicinal plants of East Africa, East African Literature Bureau, Nairobi.

Kokwaro, J.O. (1983) An African knowledge of ethnosystematics and its application to traditional medicine, Bothalia Vol. 14, 2: 237-245, Pretoria.

Ogunkoya, L. et al. (1972) Phytochemistry.

Osima, Y. and Kaneko, Y. (1939) Bull. Agr. Chem. Soc. Japan.

Palgrave, K.C. (1977) Trees of Southern Africa, C. Struik Publishers, Cape Town.

Polhill, R.M. (1966) Flora of Tropical East Africa: Ulmaceae. London: Crown Agents.

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) Medicinal and Poisonous Plants of Southern and Eastern Africa, E. and S. livingstone Ltd., Edinburgh and London.

PLATE XXXVI. Trema orientalis (L.) Blume

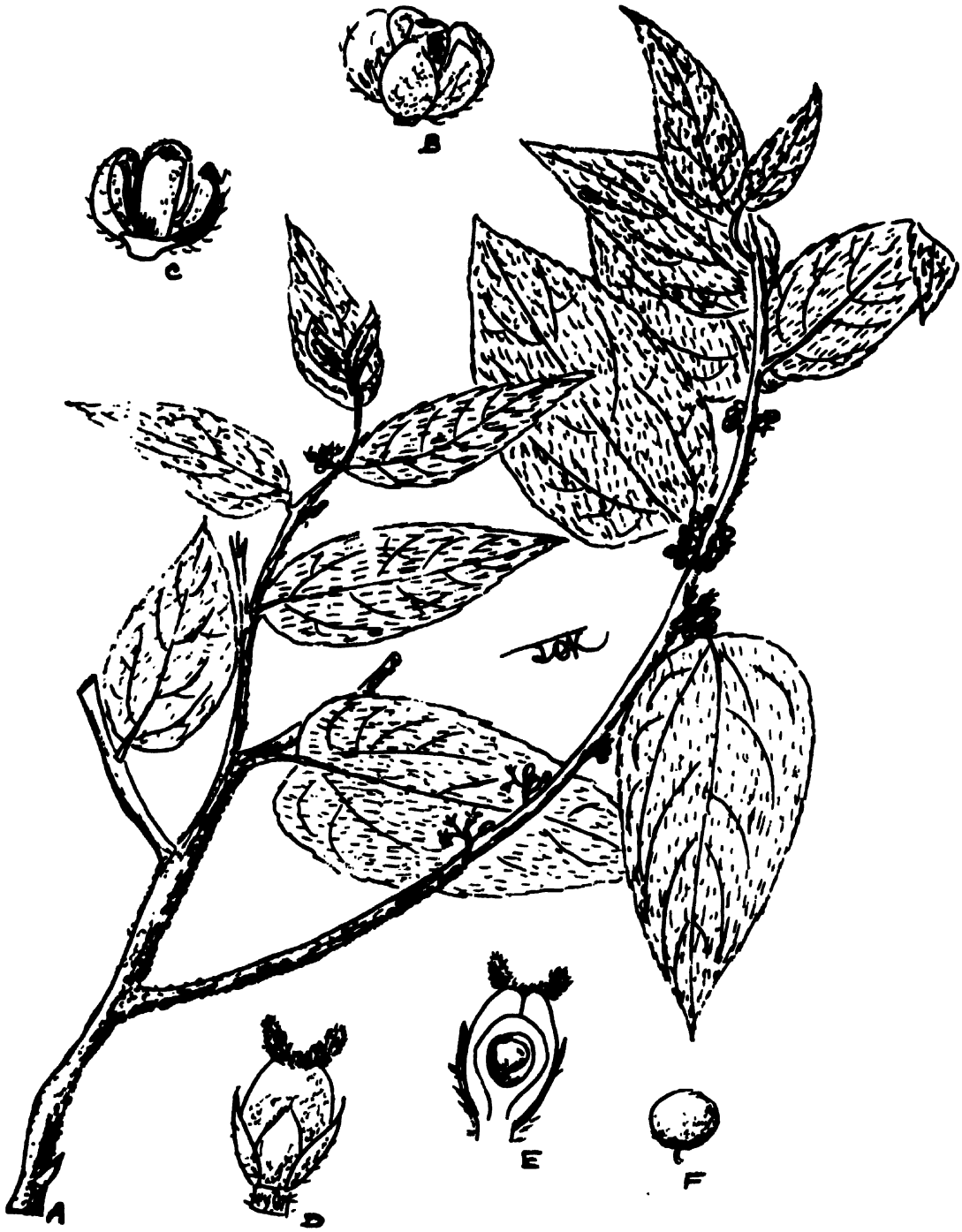
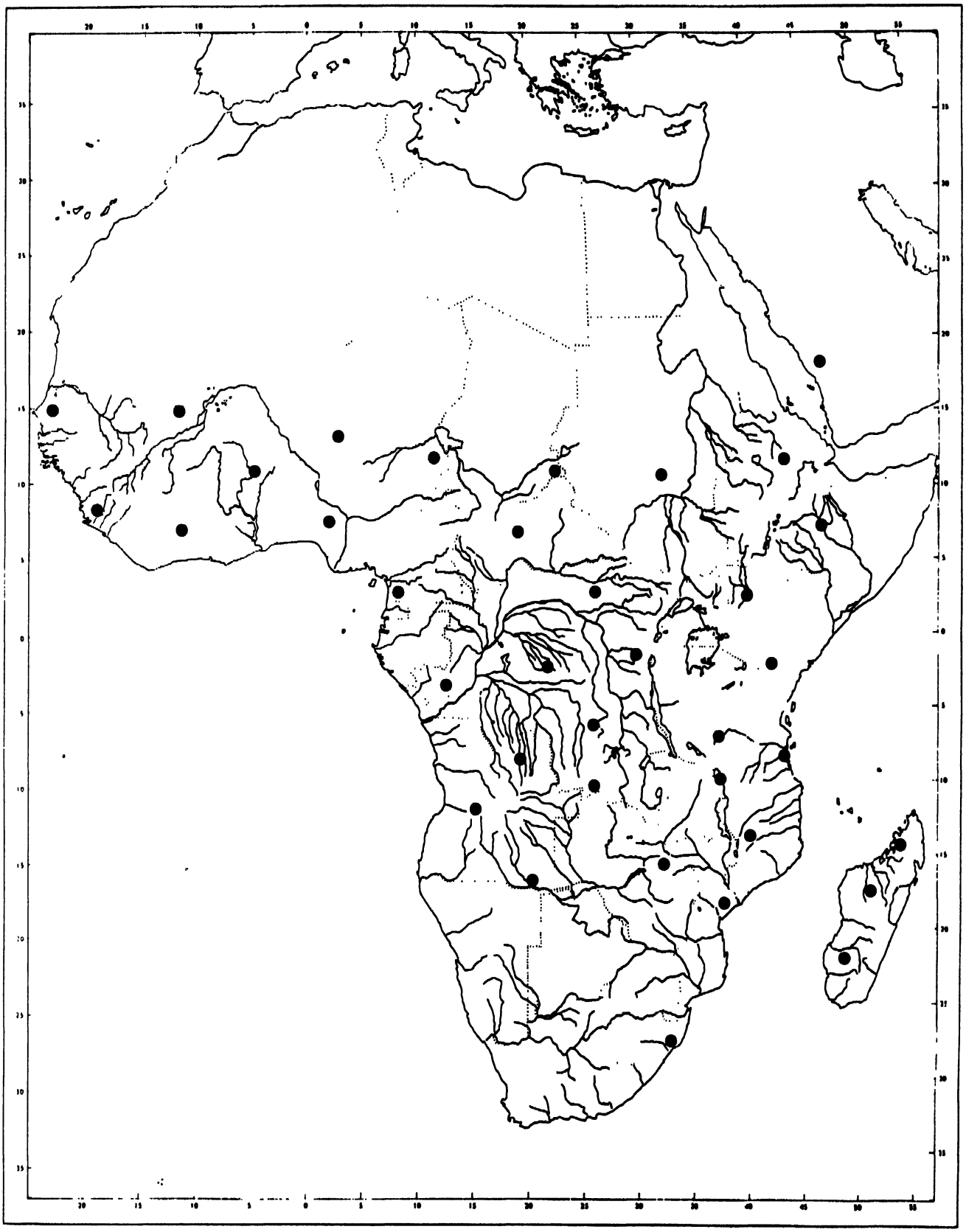


Plate XXXVI. Trema orientalis (L.) Blume

A. flowering fruiting branch
B. male flower
C. longitudinal section of male flower
D. female flower
E. longitudinal section of female flower
F. fruit

MAP 36 - Geographic distribution of Trema orientalis



1. BOTANICAL NAME: *Trichilia emetica* Vahl

SYNONYMS: *Trichilia umbrifera* Swynn.
Trichilia somalensis Chiov.
Trichilia grotei Harms
Trichilia roka Chiov.
Trichilia jubensis Chiov.

FAMILY: Meliaceae

COMMON NAMES: subsp. *emetica* Safsâfa (Arabic), Apolgum (Dinka), Korillon (Bari); Gumeh (Tigre Prov.), Roqáh, rugáh, rogäh, roka (Yemen); Goro-mas (Somali); Mukeko, Mukeka (Kilia); Msikitsi, Mwavi (Chinyanja); M'chekeri, Mafurreia (Portuguese), Musikidzi, Mushikiri or Misikiri (Chindao), Nkhuhlu or umkuhlu (Singuni); Mhisi (Swaziland); Miti-mai, Mnwamaji, Mnwamai (Swahili), Mururi(Kikuyu), Ol-Sogonoi, Ol-Sokonoi (Masai), Sorget, Sok (Kamasia), Musunui (Meru), Omenyakige (Kisii), Mkolimazi, Musikili (Tanzania), Ethiopian mahogany, Natal mahogany, Mushikishi (Bemba), Musikili (Lozi, Tonga), Msikizi (Nyanja).

subsp. *suberosa* Bouriète (Diola); Quècó (Mandinga); Flo-finzan, Soula-finzan or Foula-finzan (Bambara); Kikiramtanga-ouamtabéga (Mossi); Chele, Yofuosi, Kisiga, Asabrabise (Ashanti); Jan saiwa (Hausa), Ashapa (Yoruba); Umshara, Um hagi (Arabic).

2. ECOLOGY AND DISTRIBUTION

Widespread through the savanna region of tropical Africa. Subsp. *emetica* occurs in the open savanna woodlands subject to grass fires while subsp. *suberosa* is generally confined to the more fertile soils of the river banks and seasonally flooded river beds. The species, as a whole, occurs between 300 and 1500m above sea level in areas receiving between 500 and 1800mm rainfall per annum with a dry season varying between 4 and 8 months.

Subsp, *emetica* is confined to eastern Africa and occurs in Sudan, Ethiopia, Somalia, Zaire, Uganda, Kenya, Tanzania, Zambia, Zimbabwe, Malawi, Mozambique, Botswana, Angola, Namibia, Swaziland and North Yemen, possibly introduced into Madagascar and Réunion.

Subsp. *suberosa* extends from West Africa to the Sudan and Uganda, where it may possibly hybridize. It has been recorded from Senegal, Gambia, Guinea Bissau, Guinea Mali, Ivory Coast,Burkina Faso, Ghana, Togo, Dahomey, Nigeria, Cameroon, Central African Republic, Sudan and Uganda (see distribution map).

3. DESCRIPTION

A shrub to medium-sized deciduous or evergreen tree 2-30m high, up to 90cm in diameter, bark grey to brown, smooth to rough or corky; slash deep reddish-pink or red-brown below the cork, paler inwards, colourless or off-white latex. *Leaves* alternate, compound, stipuls absent; petiole and rachis 3.5-35cm long; leaflets (1-)3-6 opposite or subopposite pairs plus a terminal leaflet, distal leaflets larger, narrowly elliptic, oblong or obovate to elliptic, oblong or obovate, 1.5-15cm long, 1-6.5cm wide, apex obtuse or notched, base acute to cuneate, margins entire, often rolled under, dark glossy green above, pubescent to tomentose below, rarely glabrous, vennation indistinct; petiolules 1-6mm long, up to 19mm long for the terminal leaflet. *Inflorescence* lax or congested,

axillary, paniculate cymes, 1.5-14cm long; flowers 5-merous, monoecious but with very little external differences between sexes. Calyx cup-shaped, deeply lobed almost to the base, lobes ovate, 1.5-7mm long, 2-5mm wide, pubescent, margins ciliate; petals cream, narrowly obovate, 8-20mm long, 2.5-7mm wide; staminal tube 7.5-12mm long, 10-fid; ovary ovoid to obovoid, 2.5-5mm in diameter, 3-celled. Fruit a creamy-brown, subspherical capsule 2.5-4cm in diameter, splitting into (2-)3(-4) valves, with a distinct neck or stipe connecting the base of the capsule to the stalk; seeds black, 2 per cell, planoconvex, 15-20mm long, 11-13mm wide, almost completely enveloped by the scarlet aril, simulating the vacant expression of a doll's eye (De Wilde, 1968).

In East Africa the main flowering season for subsp. emetica is from August to October with some flowering in January but few or no records from April to July and in December. Fruits were found in July and from December to February. In West Africa the flowering season in Cameroon is from October to November (De Wilde, 1968).

The two subspecies may be recognised according to the following key:

1. Medium-sized evergreen tree 5-30m high, 30-90cm in diameter; bark never corky. Inflorescences often condensed, rarely more lax. Savanna woodlands, generally in the vicinity of rivers. Sudan and Ethiopia southwards to South Africa, also in North Yemen.....subsp. emetica

2. Shrub or small tree, more or less deciduous, 2-10m high, 3.5-20cm in diameter; bark soft, corky. Inflorescences lax, rarely more condensed. Forest-savanna mosaic and savanna woodlands, often fire-swept. Senegal eastwards to Sudan and Uganda.....subsp. suberosa

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None known to date.

5. FOLK MEDICINAL USES

An infusion of pounded bark is used as a remedy for pneumonia. A decoction of the roots is taken as a remedy for colds, as a diuretic or to induce labour in pregnant women. A decoction of the bark is drunk as a purgative or emetic. Pounded bark is soaked in water and the paste rubbed on itch, ringworm and other parasitic skin diseases. The seed oil is applied to sores, ringworm, itch, and other skin diseases.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The seeds consist of roughly 23% of an oily shell-like husk and 77% kernel. The kernels contain 55-65% of a brownish fat and 13% protein. The nuts represent a potential source of nutrients which would be welcome in many areas. The oil contains 38.8% palmitic, 2.2% stearic, 48.5% oleic, 10.4% linoleic, and 1.0% linolenic acid. Unfortunately, the use of oil and meal for edible purposes is prohibited by a bitter taste and by emetic properties. Fupi and co-workers (1962) have investigated various aspects of nut oil and meal processing and purification. The moisture, ash, furfural index, and lignin contents of the wood have also been determined (Oliveira and Sousa, 1971).

7. HARVESTING, CONSERVING AND PREPARATION

No details available.

8. ECONOMICS AND MARKETING

No details available, only limited local markets.

9. SILVICS

It regenerates naturally through seeds, and is sometimes planted in African reforestation projects.

10. MAJOR DISEASES

Unknown.

11. OTHER USES

The seeds yield an oil which was used locally in East Africa for soap making and exported for the same purpose. The wood is useful for building and furniture making.

12. BIBLIOGRAPHY

Engelter, C. and Wehmayer, A.S. J. Agric. Food Chem., 18, 25. (1970)

Fupi, V.W.K. and Hork, P.C. J. Am. Oil Chem. Soc., 59, 94. (1982)

Oliveira, C.S. and Sousa, O.C. Rev. Cienc. Agron., Ser. B.4. 3. (1971)

De Wilde, J.J.F.E. (1968) A revision of the species of Trichilia P. Browne (Meliaceae) on the African continent. Meded. Landbouwhogeschool Wageningen 68,2:1-207.

Dale, I. R. and Greenway, P.J. (1961) Kenya trees and shrubs. Government of Kenya and Hatchards. 187 Piccadilly, London W.I.

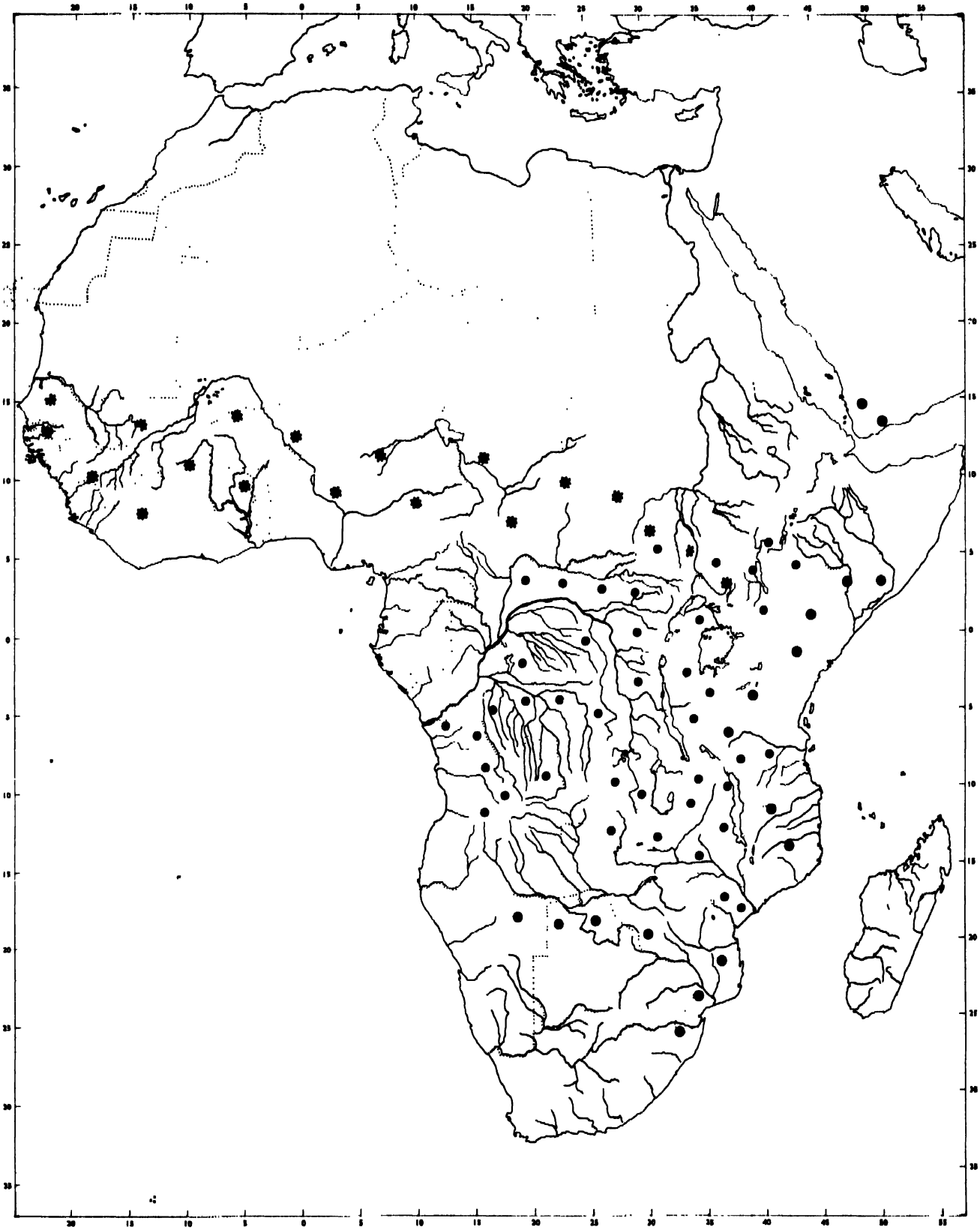
PLATE XXXVII. Trichilia emetica Vahl.

Plate XXXVII. Trichilia emetica Vahl.

A. flowering branchlet

B. young fruits

MAP 37 - Geographic distribution of Trichilia emetica



1. BOTANICAL NAME: Warburgia ugandensis Sprague

SYNONYMS: Warburgia breyeri Pott

FAMILY: Canellaceae

COMMON NAMES: East African Greenheart, Pepper-bark Tree, Muziga, Museka (Kikuyu), Ol-Sokoni (Masai), Sorget, Sok (Kamasia), Musuni (Meru), Omenyakige (Kisii).

2. ECOLOGY AND DISTRIBUTION

Warburgia ugandensis occurs in lowland rain-forest, upland dry evergreen forest and its relicts in secondary bushland and grassland; also on termitaria in swamp forest.

It occurs in Ethiopia, Zaire, Uganda, Kenya, Tanzania and Transvaal (see distribution map).

3. DESCRIPTION

A spreading evergreen tree 5-20(-27)m high, 70cm in diameter, bark rough and rich brown, slash pink; bole short and clear of branches for c.3m. Leaves alternate, simple, gland-dotted, stipules absent; petiole 1-5mm long; blade oblong-lanceolate, elliptic or oblong-elliptic, 3-15cm long, 1-5cm wide, apex and base tapering, margins entire, glossy dark green above, paler green and dull below, midrib frequently slightly off-centre. Flowers solitary or in small 3-4 flowered cymes, axillary, regular, bisexual; bracts ovate-kidney-shaped, thick, 3mm long, 3-3.5mm wide, only covering the young buds. Sepals green, ovate, 6-7mm long, 4-4.5mm wide; petals 10, in whorls, white or greenish, obovate, 5-7mm long, 2.5-3mm wide, gland-dotted, overlapping; stamens 10, united into a tube 4-5mm long, 2-3mm in diameter, enveloping the ovary and most of the style; ovary oblong-elongate, 2.6-4mm long. Fruit at first green and ellipsoidal, later subspherical and turning purplish, up to 5cm in diameter, skin leathery, glandular; seeds compressed, more or less cordate, yellow-brown, 1-1.5cm long (Verdcourt, 1956).

Flowering at the beginning of the rainy season; fruits formed later in the rainy season and may remain on the tree for a long time.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

None known to date.

5. FOLK MEDICINAL USES

Dried bark is commonly chewed and the juice swallowed as a remedy for stomach-ache, constipation, coughs, colds, fever, muscle pains, weak joints and general body pains. The bark may also be chewed for toothache. It is also used in powdered form for treatment of the same diseases. Fresh roots are boiled and the decoction mixed with soup which is drunk by the Kikuyu of Kenya for the prevention of diarrhoea. Leaves are boiled and the decoction used for bathing as a cure for several unspecified skin diseases.

The tree has been used medicinally from early times. Under the name Warburgia salutaris as it is sometimes known, the specific name means "salutary" or "health giving". The inner bark is reddish, bitter and peppery and has a variety of applications as described above. It provides treatment for the common cold; dried and ground to a snuff it is used to clear sinuses; it is chewed, or smoke from the burning bark is inhaled as a remedy for chest complaints. The bark and roots can be boiled in water and the decoction drunk for the treatment of malaria.

There is a high demand for the tree because of its medicinal value to the local people and large trees have been constantly destroyed by herbal traders who harvest the bark in large quantities and take them to markets for sale. This is a well known problem in all African countries wherever this species is found.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The heartwood contains new sesquiterpenoids such as drimenol, warburgin, warburgiadione, ugandensolide, ugandensidial, polygodial, cinnamoide, bemadienolide, warburganal, and muzigadial. These compounds exhibit antifeedant activity against army worm Spadoptera littorialis and S. exepta, widely occurring in African crop pests. The antifeedant activity of warburganal and muzigadial are comparable. These two compounds belong to the strongest group of antifeedant against African army worm found so far. In addition, they exhibit very potent antifugal, antiyeast and plant-growth regulatory activities.

7. HARVESTING, CONSERVING AND PREPARATION

As described in paragraph 4.

8. ECONOMICS AND MARKETING

No details of local marketing opportunities, but a lively demand appears to exist for the raw material.

9. SILVICS

Regeneration is primarily from seeds which will germinate easily in the natural forests.

10. MAJOR DISEASES

Unknown.

11. OTHER USES

The timber has a high oil content, burns with an incense-like smell, saws easily, planes well and takes a high polish, but is liable to split on nailing. The resin is used by natives to fix tools in handles. The bark, leaves, fruit, and young twigs are very hot to the taste. The leaves are sometimes used by Indians in East Africa in their curries. The wood somewhat resembles teak and shows a satin lustre; its fragrance persists during 4 years' storage. Milling of the wood gives rise to a dust which is intensely fragrant and causes sneezing.

12. BIBLIOGRAPHY

Brooks, C.J.W. and Draffan, G.H. Tetrahedron. 25, 2865 (1969)

Brooks, C.J.W. and Draffan, G.H. Tetrahedron. 25 2287. (1969)

Dale, J.R. and Greenway, P.J. (1961) Kenya Trees and Shrubs. Government of Kenya and Hatchards, 187 Piccadilly London W.1.

Kubo, I. et al. (1976) J.C.S. Chem. Comm. 1013

Kubo, I. et al/ (1977) Tetrahedron Letters. 1553

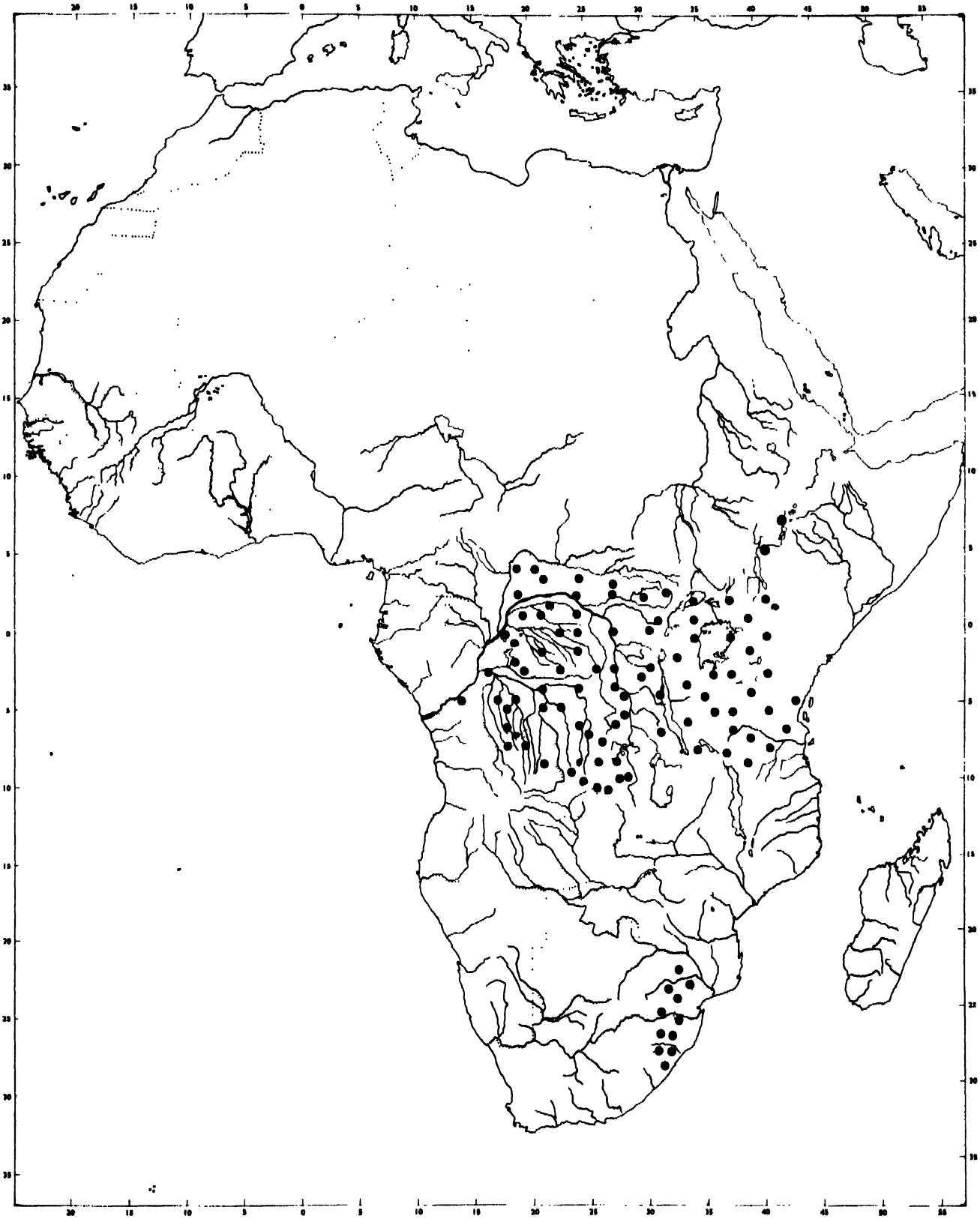
Verdcourt, B. (1956) Flora of Tropical East Africa: Canellaceae. London: Crown Agents.

PLATE XXXVIII. Warburgia ugandensis Sprague

Plate XXXVIII. Warburgia ugandensis Sprague

A. sketch of tree
B. flowering branch
C. flower
D. fruit

MAP 38 - Geographic distribution of Warburgia ugandensis



1. BOTANICAL NAME: Xylopia aethiopica (Dunal)A.Rich.

SYNONYMS: Unona aethiopica Dunal
Xylopia eminii Engl.

FAMILY: Annonaceae

COMMON NAMES: Kimba (Hausa), Kimbare (Fulani), Kyimba (Arabic), Tsunfyanyi (Nupe), Erunje, Eru (Yoruba), Unien (Bini), Atta (Efik), Ata (Ibibio), Uda (Ibo).

2. ECOLOGY AND DISTRIBUTION

Xylopia aethiopica occurs mainly in evergreen rainforest, moist lowland forest, riverine and swamp forest. In Nigeria it grows in association with Sarcocephalus diderichii, Lophira procera, Diospyros confert, Spondianthus preusii, and in the transitional woodland area with Lannea, Allophylus, Baphia and Anthocleista.

The species is widespread in tropical Africa, occurring in Senegal, Gambia, Guinea, Sierra Leone, Liberia, Ivory Coast, Togo, Dahomey, Nigeria, Gabon, Principe, Zaire, Sudan, Uganda, Tanzania, Zambia, Mozambique and Angola (see distribution map).

3. DESCRIPTION

Tall, evergreen, aromatic tree or shrub 4.5-30(-45)m high, 20cm in diameter, bole straight, sometimes buttressed; bark grey, fairly smooth, slash reddish, brown and fibrous beneath; crown much branched, branches and branchlets with numerous whitish lenticels. Leaves alternate, simple, stipules absent; petiole 2-9mm long, blade elliptic, ovate or oblanceolate, 6-17cm long, 3-6cm wide, apex obtuse to markedly acuminate, margins entire, coriaceous, dark green, glabrous above, very pale glaucous green, glabrescent below, midrib very broad at base, slightly impressed above; major lateral veins 8-12 pairs, very faint, arching and anastomosing at a distance from the margin. Inflorescence axillary with thick pedicels up to 1cm long; flowers solitary or in 3-5-flowered clusters. Sepals 3, more or less united, ovate-triangular 3-5mm long; petals 6, in 2 whorls, cream, greenish-white or yellow, outer petals linear, 2.5-5mm long, thick, gradually tapering to the apex, covered with rust-coloured hairs, inner petals shorter and narrower; stamens numerous, 1-1.5mm long; carpels numerous, up to 40 or more; ovary cylindric, 1-1.5mm long, ovules 6-8. Fruit a monocarp, cylindirical, up to 9cm long, reddish at first, eventually blackish; seeds 1-8, orange-red to black, cylindrical, vertical, 5-7mm long, 2-4mm in diameter, aril basal, papery, yellow, 2-3mm long.

In Nigeria recorded as flowering March to November, fruiting June to March.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

There is no information on modern medicinal use of extracts from this plant.

5. FOLK MEDICINAL USES

A decoction of fruit of X. aethiopica, root bark of Strychnos inoqua, Gardenia tennifolia, Olax subscorpoidea, Uvaria chamae and Anonna senegalensis is drunk as a remedy for stomach-ache. Salt may be added for taste.

Open dried fruit without seeds is burnt, ground into powder and mixed with red palm oil as a treatment for coughs.

A decoction of seven fruits of X. aethiopica, leaves of Alstonia boonei, and Wissadula amplissima is used to bathe children as an anticonvulsant.

A decoction of stem bark of Newbouldia leaves and fruit of X. aethiopica is drunk as a remedy for ammenorrhoea.

A soup of ground fruits of X. aethiopica, Piper guineense and leaves of Leptaspis cochleata is taken as a remedy for dizziness. The fruits are often used as condiment in the Yoruba native decoction (Agbo).

According to Dalziel (1937), a fluid extract or a decoction of the fruit or bark, is useful in the treatment of bronchitis, and dysenteric conditions, and also as a medicine for biliousness. As a women's remedy it is taken to encourage fertility. A poultice of the leaves and fruit is appled as a cure for headache and neuralgia.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

The following chemical constituents have been reported: Alkaloids and tannins from the leaves (Odebiyi and Sofowora, 1978); essential oil, resins and glycosides from root, bark leaves and fruits (Puri and Talata, 1964), a diterpine acid, xylopic acid shown to be 15(- acetoxy-(-) kar-16-end-19-oic acid (Ekong and Ogan, 1968) essential oils such as X and B pinenes, -3-carene, O-cymene, X-phellandene, limonene and terpinolene, 8-cineole, bisabolene, linalool, terpinen-4-01, & terpineol, cuminyl alcohol, and cuminic aldehyde, have also been reported. Oliver (1959) reported the extraction from the fruits the following essential oils:- resin, anonacein, reberoside and avocein.

7. HARVESTING, CONSERVING AND PREPARATION

Local collection of fruit, bark and roots.

8. ECONOMICS AND MARKETING

Collected and marketed locally.

9. SILVICS

Regenerates naturally from seed.

10. MAJOR DISEASES

None described in literature available.

11. OTHER USES

The wood is said to resist the attacks of white ants, and is often used for native house-posts (Foster, 1914; Dalziel, 1937). Pieces of bark are used for the side walls of huts in certain parts of Nigeria; the light, flexible wood recommend it for use as paddles, masts and spars of small boats as well as for bows.

The fruits, pulverised with Capsicum fruit peppers are mixed with kolanuts to prevent the ravages of the kola weevil (Dalziel, 1937).

12. BIBLIOGRAPHY

Dalziel, J.M. (1937) The Useful Plants of West Tropical Africa. London: Crown Agents.

Ekong, D.E.U. and Ogan, A.U. (1968) Chemistry of the constituents of Xylopia aethiopica. The structure of xylopic acid, a new diterpine acid. Journal of the Chemical Society (C): 311.

Foster, E.W. (1914) Annonaceae - Notes of Nigerian Trees and Plants. London: Biddle and Son.

Odebiyi, O.O. and Sofowora, E.A. (1978) Phytochemical screening of Nigerian medicinal plants, II. Lloydia 41,3: 234-246.

Oliver, B. (1959) Medicinal Plants in Nigeria. Ibadan: Nigeria College of Arts, Science and Technology.

Puri, S.G. and Talata, D. (1964) A survey of some plants used in native medicine of West Africa of interest to Indla. Paper presented in 'A Symposium on Recent Advances in the Development, Production and Utilisation of Medicinal and Aromatic Plants in India. pp 35.

PLATE XXXIX. Xylopia aethiopica (Dunal.)A. Rich.

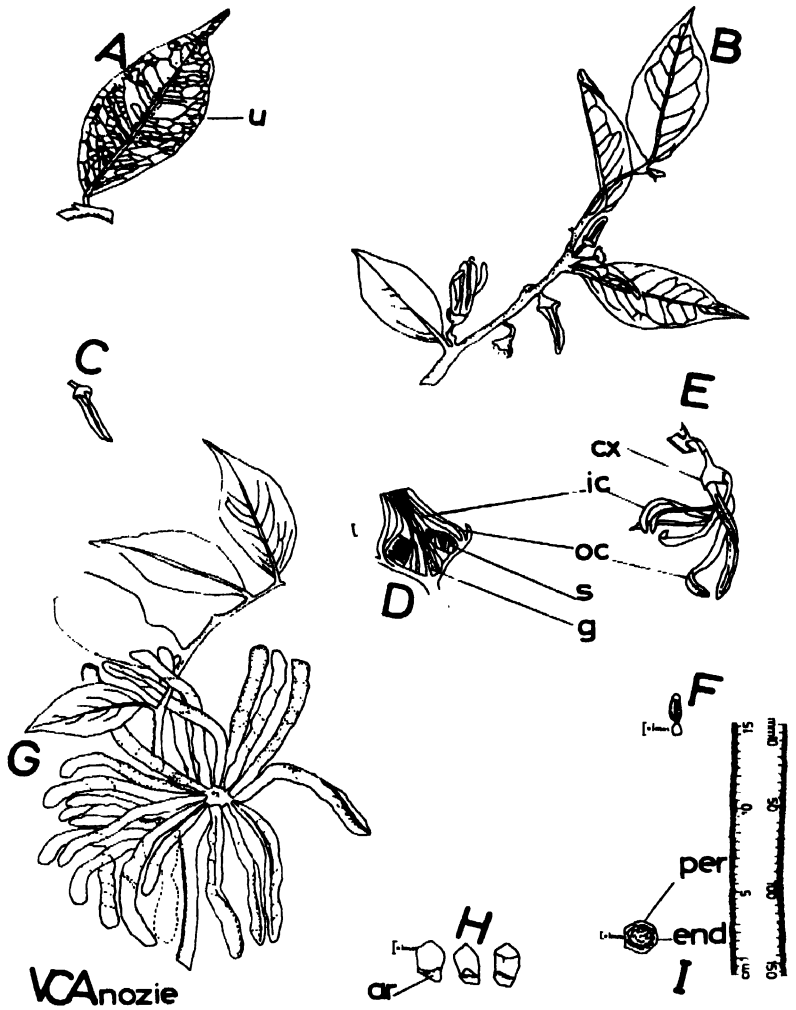


Plate XXXIX. Xylopia aethiopica (Dunal) A. Rich.

A. Vegetative leaf, adaxial surface with 2° and 3° veins (u); B. flowering shoot; C. flower bud; D. longitudinal half flower through base of bud (c) showing multipistillate gynoecium (g) and spirally arranged stamens (s); E. opened flowers; calyx (cx) outer whorl of corolla (oc) inner whorl (ic)
G. fruiting twig; H. brown seed with aril (ar); I. section of seed showing pericarp (per) and endosperm (end)

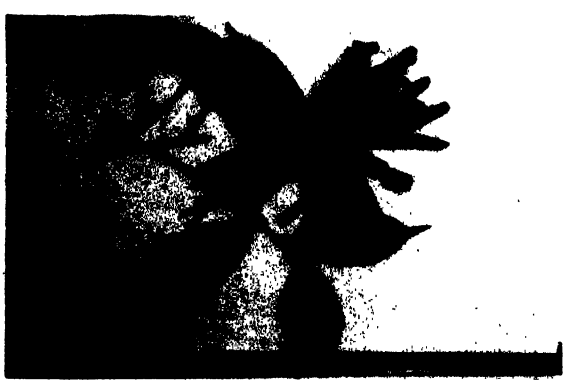
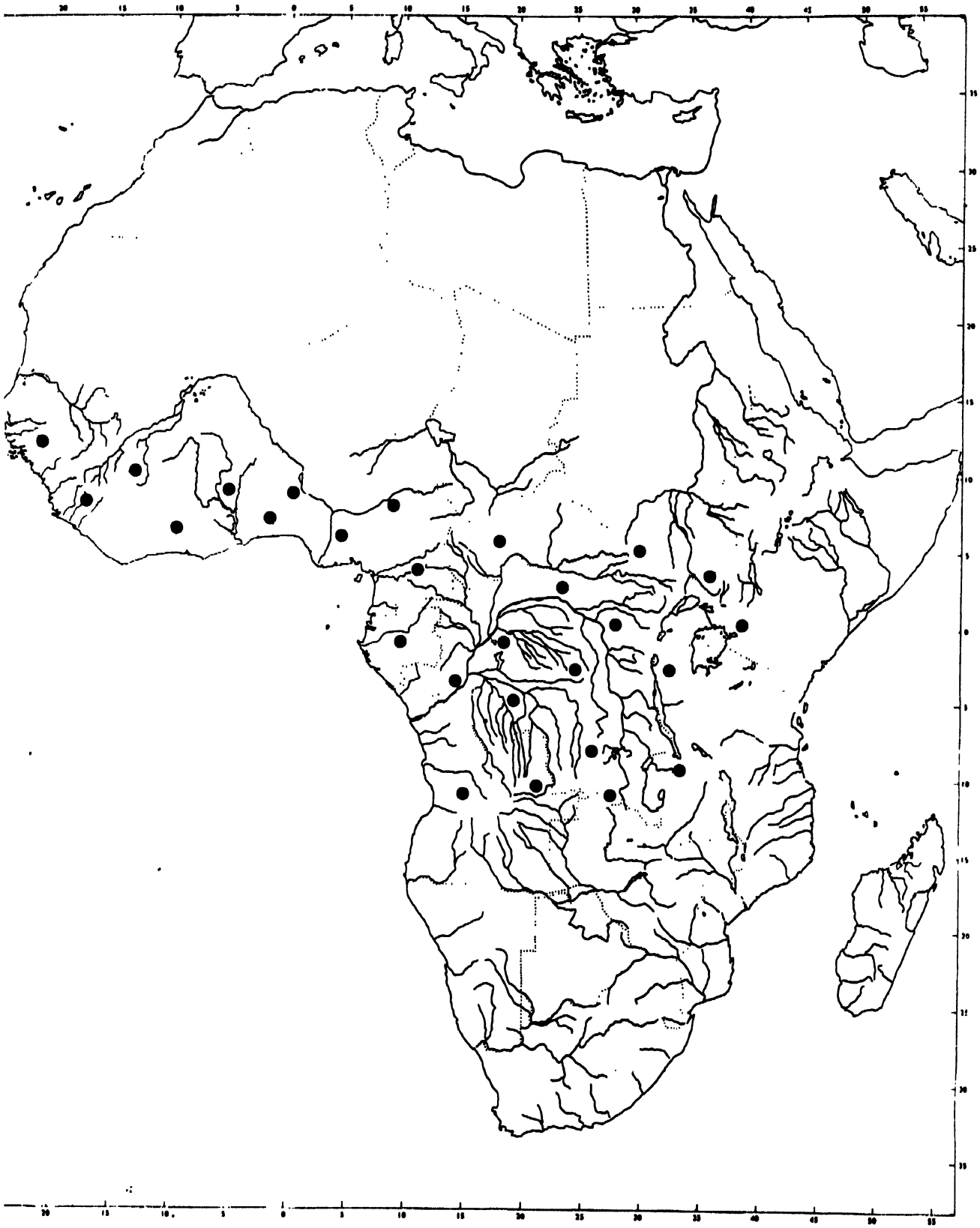


Plate XXXIX-1

Fruit bearing branchlet of Xylopia aethiopica

MAP 39 - Geographic distribution of Xylopia aethiopica



1. BOTANICAL NAME: Zanthoxylum zanthoxyloides (Lam.) Zepern. & Timler

SYNONYMS: Fagara zanthoxyloides Lam.
Zanthoxylum senegalense DC.
Zanthoxylum polygonum Schum. & Thonn.
Fagara senegalensis (DC.) A. Chev.

FAMILY: Rutaceae

COMMON NAMES: Candle wood; Yea (Ashanti, Denkyera), Kanfu (Fante), Kenge (Baule), Xetsi, Xeti (Ewe), Xe (Awuna, Krepi), Puom (Dagati), Korokori (Wala); Fasa kuwari(Hausa), Fasakorihi (Fulani), Ata (Yoruba), Ughanghan (Bini), Atufio (Etsako).

2. ECOLOGY AND DISTRIBUTION

In Nigeria Zanthoxylum zanthoxyloides occurs in the forest savanna mosaic of the moist lowland rainforest; also in coastal areas where it is sometimes abundant (Gbile, 1975).

The species is widespread in West tropical Africa, in Senegal, Gambia, Mali, Guinea, Bissau, Guinea, Ivory Coast, Ghana, Togo, Dahomey, Nigeria and Cameroon (see distribution map).

3. DESCRIPTION

Shrub or tree up to 18m high, 0.5m in diameter; trunk grey, with large woody thorns falling later and then covered with thick corky bark; slash yellow above, mottled with orange beneath; much branched, branches and branchlets armed with curved sharp spines which are green at apex, lenticellate. Leaves alternate, compound, stipules absent; rachis up to 16cm long, leaflets 3-5 opposite or nearly opposite pairs, usually with a terminal leaflet, oblong or oblong-oblanceolate, rarely elliptic or obovate, 4-10(-19)cm long, 1.7-5.5(-6.5)cm wide, apex rounded or notched or very abruptly and shortly acuminate, base broadly cuneate, margins entire, coriaceous, smooth, shining, medium green above, dull light green below, midrib impressed above, prominent below, sometimes with a few prickles, major lateral veins variable in number (8-21 pairs), prominent below, arching and anastomosing submarginally. Inflorescence axillary or terminal panicles nearly as long as the leaves, up to 4cm long. Flowers unisexual by abortion, greenish white to cream white, clustered, sessile, c.2.5mm long. Fruit red, ellipsoid, c.6mm long, 5mm in diameter, splitting into 2; seeds 1, shining blue-black, subglobose.

In Nigeria recorded as flowering January to February and May to October; fruiting July to November.

4. ESTABLISHED MODERN PHARMACEUTICAL USES

There is no established modern medicinal use of extracts from Z. zanthoxyloides, but intensive research is going on to show the great potential this plant has in phytotherapy.

5. FOLK MEDICINAL USES

A tablespoonful of mixture of powdered stem bark of Zanthoxylum zanthoxyloides, fruits of Piper guineense and fruits of Xylopia aethiopica is mixed with pap and drunk every morning as a cure for general body weakness until patient gets well.

As a treatment for swollen legs or elephantiasis, a decoction made from the leaves of Zanthoxylum zanthoxyloides and fruits of Xylopia aethiopica is drunk.

A paste mixture of powdered stem bark of Zanthoxylum zanthoxyloides and fruit of Piper guineense applied to the affected part of the body has been found effective as a way of checking over-development of the spleen.

To cure tooth-ache, root powder is applied to the gum of the affected tooth for about five minutes. The root used as a chewing stick is reported to hasten healing. The antimicrobial property of the chewing stick has been investigated by El. Said et al. (1971). See also Lewis & Elvin-Lewis, 1977.

To cure a sore throat salt is added to powdered root bark, two tablespoonfuls are taken in warm or cold water twice daily until well. In cases of indigestion a teaspoonful of powdered root bark taken in warm water eases stooling.

Root bark is soaked in sterile water for twelve hours, a tablespoonful of resulting solution is taken three times daily to treat gonorrhea or as a urinary antiseptic (Oliver, 1959).

As a cure for impotence a bit of dried ground mixture of root bark with the organs of a hippopotamus, goat and cock is eaten with corn meal pudding or warm water every morning.

Sufferers from sickle-cell anaemia are encouraged to drink a decoction of boiled roots of Z. zanthoxyloides.

For obesity, the washed root bark is dried, scraped with a snail shell and powdered. The powder is then rubbed all over the body. A portion of scraped bark is also boiled in a clay pot and the resulting liquid is used for bathing.

6. MAJOR CHEMICAL CONSTITUENTS AND MEDICINAL PRODUCTS

Oliver (1959) reported the following constituents - skimminianine, fagaridine, artarine, fagarine oil, fagarol and pseudofagarol from the root bark. The action of artarine, according to Dalziel (1937) is to cause muscular irritation and physiological effects similar to those caused by vetratrine and the former may be a possible substitute for the latter in medicine. Lewis & Elvin-Lewis (1977) reported the isolation of fagoronine from the root bark.

In Nigeria, major research on possible medicinal use is focused on isolation and characterisation of antisickling agents from the root of this plant. Sofowora and Isaacs (1971) reported the reversal of sickling and crenation in erythrocytes by the root extracts of Z. zanthoxyloides. From the phenolic fraction of the timber oil of this species, Eshiett and Taylor (1966 and 1968) isolated and characterised xanthoxylol which when tested showed antisickling activity in vitro (Adeoye, 1978). Sofowora et al. (1975) identified and isolated 2 - hydroxymethyl benzoic acid as an antisickling agent from the root of the species.

Other extracts reported by these authors include alkaloids, resins, phenolics, saponin and oil. Odebiyi and Sofowora (1978) reported alkaloids, saponin, and tannin from the root, stem and bark of Z. zanthoxyloides while Okogun et al. (1978) identified among other extracts, glycosides - hesperidin and diosmin. Hesperidin has been reported to be an antifertility agent. Terpenoids, alkaloids, phenols and flavonoids were also reported by the the latter authors.

7. HARVESTING, CONSERVING AND PREPARATION

No details other than under section 5.

8. ECONOMICS AND MARKETING

Marketed locally.

9. SILVICS

Regenerates naturally from seed.

10. MAJOR DISEASES

None known.

11. OTHER USES

A mixture of the pounded seeds of Zanthoxylum zanthoxyloides and the kernels of Detarium sp. is used for flavouring butter (Dalziel, 1937). The ripe seeds may also be used as pepper. In Senegal the seeds are used for necklaces. The dried and pulverised leaves are sometimes used in West Africa to flavour food. In certain villages in Ghana the leaves are fed to sheep (Irvine, 1961).

Dickson and Giwa (1980) reported that the tannin extract from Z. zanthoxyloides when mixed with a certain proportion of bark extracts from Rhizophora spp. improves both the colour and penetration hides and skins to an acceptable degree, hence could be used to tan skins or leather.

The wood is extremely hard, close grained, durable and termite proof; it is sometimes figured and likened to satinwood (Dalziel, 1937). The timber is used for building purposes and is also an excellent firewood. The branches contain an inflammable resin and are used for processional torches by the villagers. The young shoots are used as chewsticks.

12. BIBLIOGRAPHY

Adeoye, A.O. (1978) — Phytochemical investigations for the establishment of pharmocopoeial standards in Fagara species. Nigeria, University of Ife, Ile-Ife; M. Phil. (Pharmacognosy) thesis (unpublished).

Dalziel, J.M. (1937) — The Useful Plants of West Tropical Africa. London: Crown Agents.

Dickson, B. and Giwa, S.A.O. (1980) The tannin content of extracts of some Nigerian tree tree species and their leather tanning properties. Nigeria, Leather Research Institute, Zaria: Proceedings of the national seminar on the current problems facing the leather industry in Nigeria: 28.

El Said, F.,Fadulu, S.O., Kuye, J.O. and Sofowora, E.A. (1971) Native cures in Nigeria. II. The antimicrobial properties of the buffered extracts of chewing sticks. Lloydia 34, 1: 172-174.

Eshiett, I.T. and Taylor, D.A.H. (1966) Extractives from Fagara xanthoxyloides Lam. Chemical Communications 14: 467.

Eshiett, I.T. and Taylor, D.A.H. (1968) The isolation and structure elucidation of some deratives of dimethylallykoumarin, chromone, quinoline and phenol from Fagara species and from Cedrelopsis grevel. Journal of Chemical Society (C) : 481.

Gbile, Z.O. (1975) Key to the Fagara species in Nigeria. Nigerian Journal of Science 9,2: 337.

Irvine, F.R. (1961) Woody Plants of Ghana. London: Oxford University Press.

Lewis, W.H. and Elvin Lews, M.P.F. (1977) Medical Botany. New York: Wiley Interscience.

Odebiyi, O.O. and Sofowora, E.A. (1978) Phytochemical screening of Nigerian Medicinal Plants II. Lloydia 41,3: 244.

Okogun, J.I., Avofor, J.F., Ekong, D.E.U., and Enyenihi, V.U. (1978) Extracts from the roots of the Nigerian and Cameroun varieties of Fagara xanthoxyloides. Nigerian Journal of Science 12,1 & 2: 591.

Oliver, B. (1959) Medicinal Plants of Nigeria. Ibadan: Nigeria College of Arts, Science and Technology.

Sofowora, E.A. and Isaacs, W.A. (1971) Reversal of sickling and crenation in erythrocytes by the root extract of Fagara zanthoxyloides. Lloydia 34,4: 383-385.

Sofowora, E.A., Isaacs-Sodeye, W.A. and Ogunkoya, L.O. (1975) Isolation and characterisation of an antisickling agent from Fagara zanthoxyloides root. Lloydia 38,2: 169-171.

PLATE XXXX. Zanthoxylum zanthoxyloides (Lam.) Zepern. & Timler

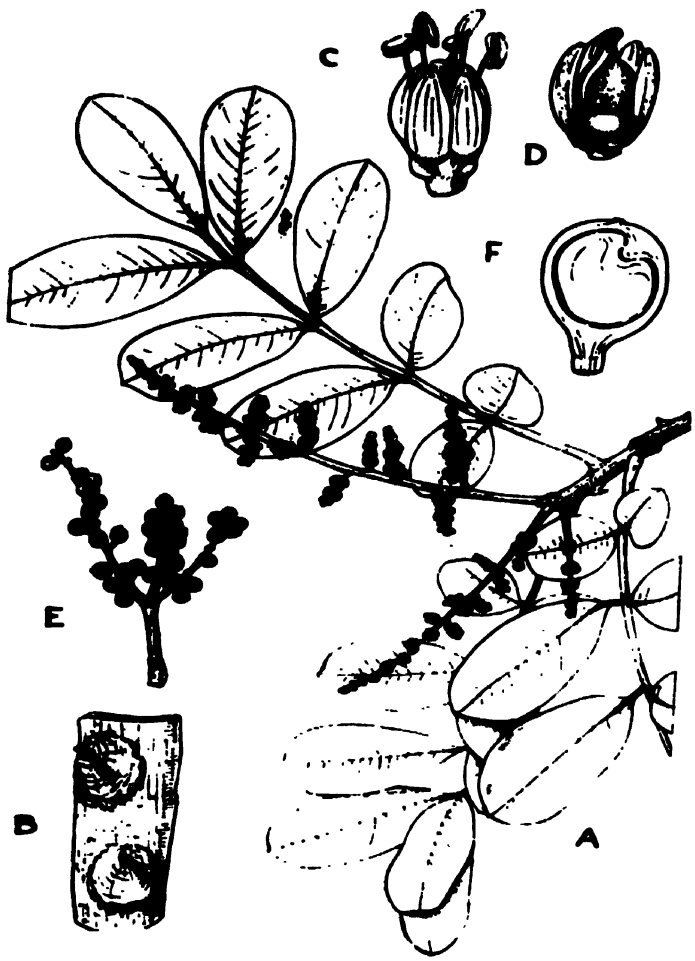


Plate XXXX. Zanthoxylum zanthoxyloides (Lam.) Zepern. & Timler

A. flowering shoot B. thorns C. and D. flowers
E. fruits F. longitudinal section of fruit

(Source: Keay et al., 1964)

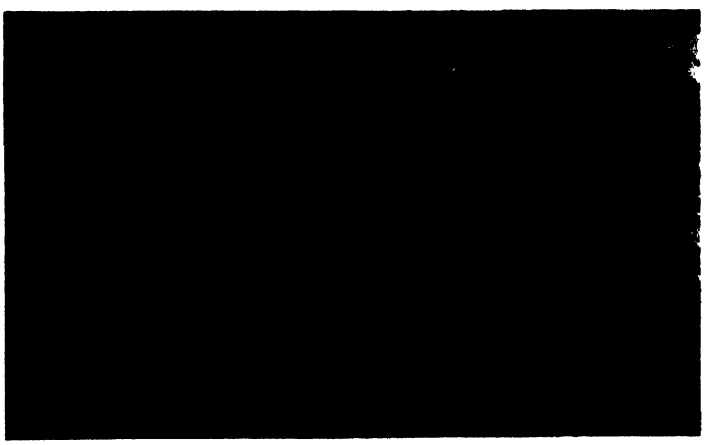
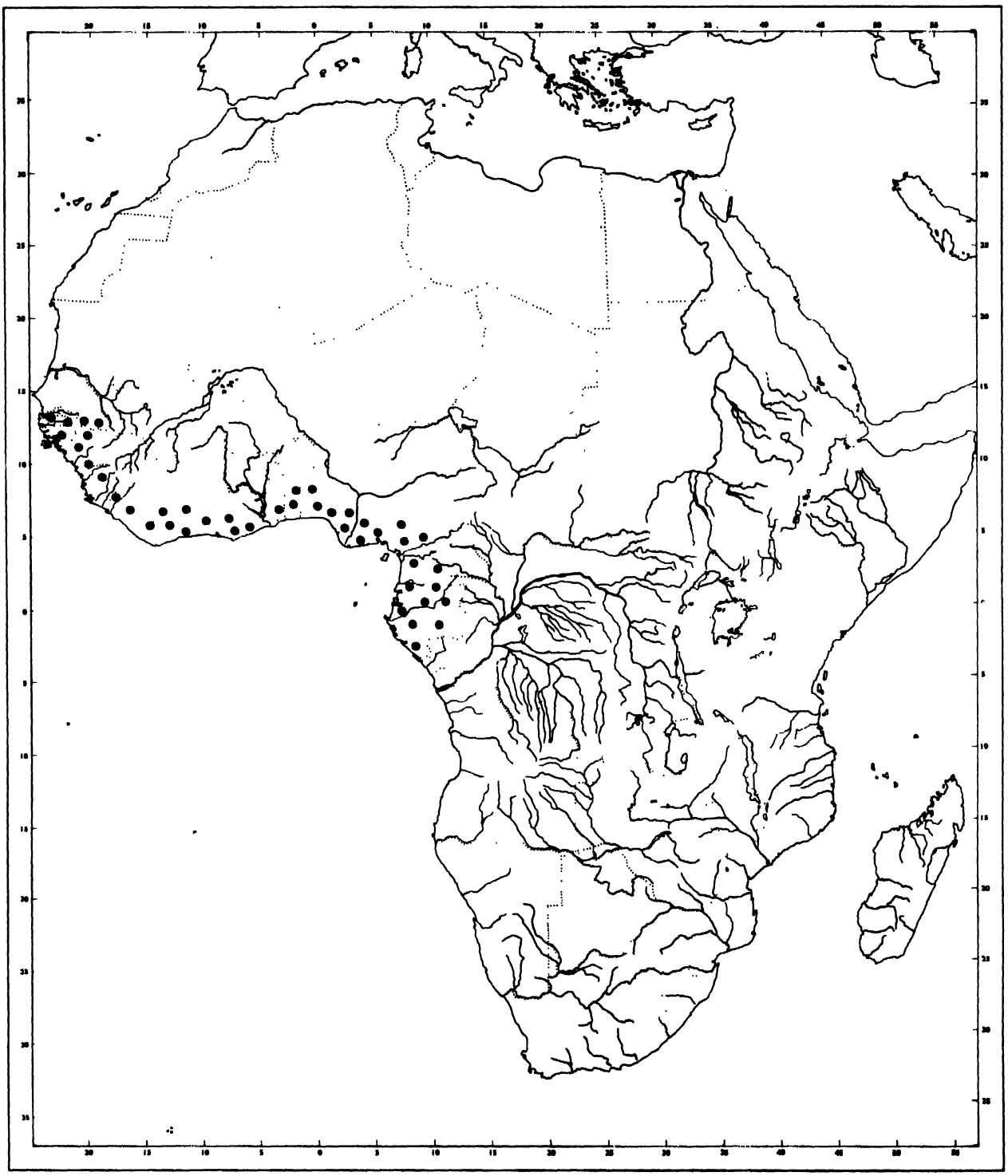


Plate XXXX-1

Stem of Zanthoxylum zanthoxyloides

MAP 40 - Geographic distribution of Zanthoxylum zanthoxyloides



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